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DESCRIPTIVE CATALOGUE
OF
ESSENTIAL OILS
AND
ORGANIC CHEMICAL PREPARATIONS

COMPILED BY
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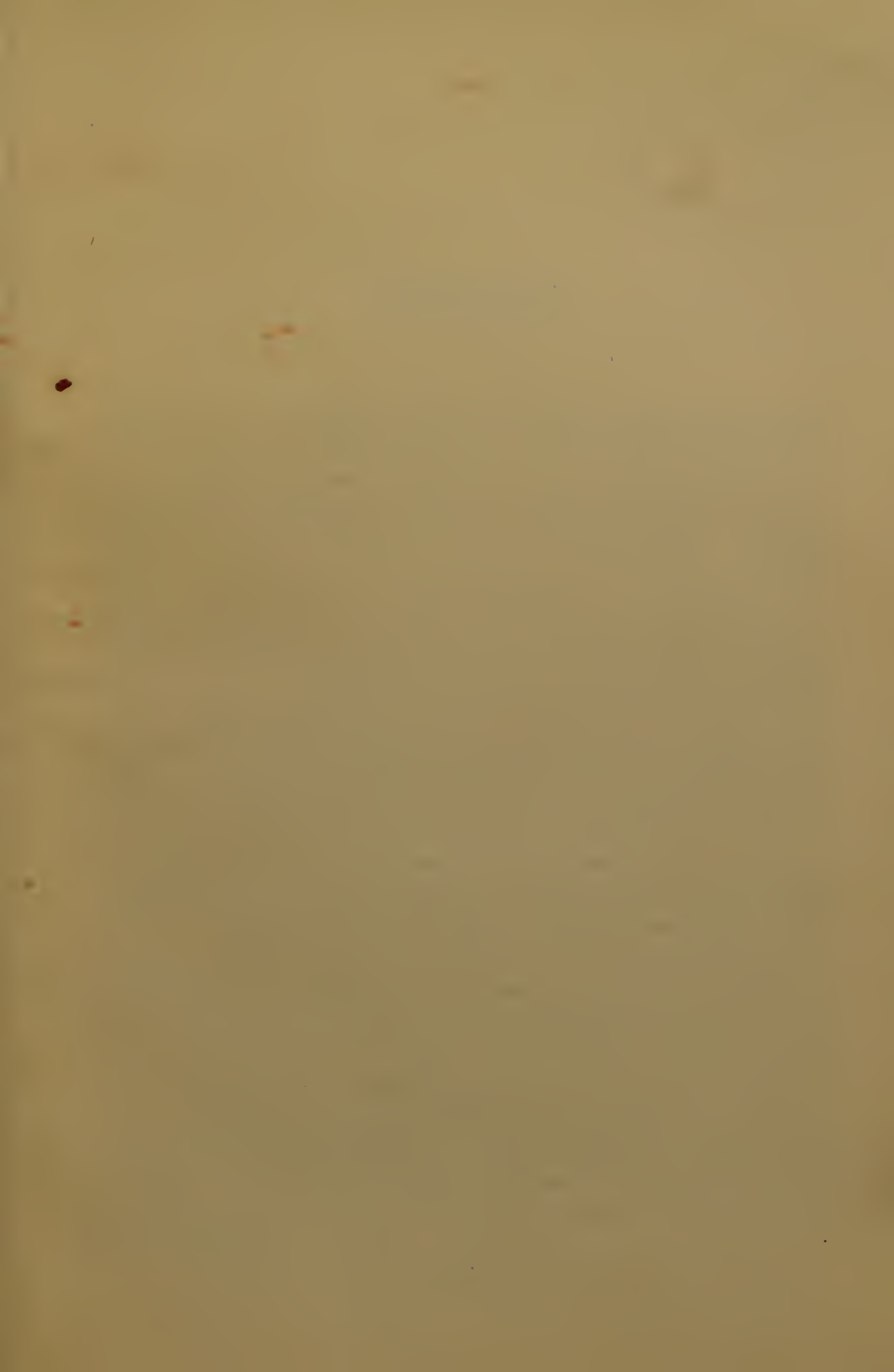
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PREFACE.

THE title of the little work here presented is believed to correctly indicate its character and scope. It was not the design to produce a treatise on essential oils in which all the points of interest connected therewith might be considered, such as the character and commercial sources of the crude materials, and the methods of obtaining the oils therefrom, nor has any attempt been made to present detailed information regarding the chemical characters of the large number of individual substances of which the various essential oils are composed. The aim of this compilation was rather to bring together in a somewhat classified and convenient form all the essential oils and chemical preparations which are now or have heretofore been produced in either our American or German laboratories, with a synopsis of their principal characters, such as botanical source, physical properties, chemical constituents or composition, tests for purity, etc.

Although a few of the oils here enumerated are not regularly manufactured by us, they represent in such cases either those which have been distilled for purely scientific or experimental purposes, and often for the first time, or those which, for commercial purposes, are produced almost exclusively in their native countries, such as the oils of the Citrus fruits, Cassia Oil, the Indian Grass Oils, and similar important articles, but which have been prepared in the laboratories of our Leipsic house on a smaller scale for the purpose of establishing the chemical and physical characters of perfectly pure products. Through the controlling influence of such investigations many foreign oils which were heretofore largely adulterated, even at the place of production, have been greatly improved in quality, and greater uniformity attained.

While the essential oils produced in our American laboratories and in those of our Leipsic house are known to be absolutely pure, and to represent normal distillates from the best crude material, the investigations referred to have rendered it possible for us to adopt standards of purity for oils not distilled by ourselves, and thus to furnish these from the first sources of supply, and also of the finest attainable quality. As an example of our endeavors in this direction, we may refer to the investigation of Oil of Peppermint.

It will be apparent that in the preparation of this little work the facts and information have been chiefly gathered from the series of "Berichte" or "Semi-Annual Reports" regularly issued by our Leipsic house (Messrs. Schimmel & Co.). These have been carefully reviewed for this purpose, and special aid has been afforded in the task by utilizing the table appended to the *Bericht (Semi-Annual Report)* for October, 1893. It may be observed, however, that the work has been so extended as to include a few oils not enumerated in the table referred to, that more detailed descriptions and tests are recorded, and a further classification adopted, which separates the oils recognized by the U. S. Pharmacopœia of 1890 from the non-official ones. A third subdivision of the work includes a list of Organic Chemical Preparations, a considerable number of which represent the well characterized and more important constituents of the essential oils.

In this synoptical treatment of the subject it was not considered expedient to include all the numerous citations of current literature relating thereto, nor was it deemed practicable to consider the large number of derivatives of individual substances, which, as those familiar with the subject are aware, would require a series of extended monographs. Those desiring more complete information on many points will naturally refer to recent works on organic and pharmaceutical chemistry and the dictionaries of chemistry, while the more important original publications may be found in Liebig's *Annalen der Chemie*, in the *Berichte der deutschen chemischen Gesellschaft* (Berlin), the *Journal für praktische Chemie* (Leipzig), *Comptes rendus* (Paris), *Bulletin de la Société chimique* (Paris), *Journal of the Chemical Society* (London), *American Chemical Journal* (Baltimore), and the leading pharmaceutical periodicals. When these sources of

information are not available, abstracts of original papers may usually be found in the *Jahresbericht der Chemie*, *Jahrbuch der Chemie* (Braunschweig), *Jahresbericht der Pharmacie* (by Dr. H. Beckurts), the British *Yearbook of Pharmacy*, and the Report on the Progress of Pharmacy in the *Proceedings of the American Pharmaceutical Association*.

It may be stated by way of explanation that, in order to avoid repetition, the specific gravities noted in the following pages refer to a temperature of 15° C., unless otherwise specified, and that the optical rotations refer uniformly to a tube of 100 millimeters. The solubilities refer to parts by volume, and to alcohol of a specified strength by volume.

In the arrangement of the official oils the descriptions are given under the official English titles, such as *Oil of Hedeoma* for Oil of Pennyroyal, *Oil of Myrcia* for Oil of Bay, etc., and with the non-official oils the descriptions follow the names by which they are most commonly known. Where this for any reason has not seemed practicable, suitable cross-references are given, which, together with a strictly alphabetical arrangement, renders a further index reference unnecessary.

In the preparation of this little work we have indulged the hope that it may be found useful for reference, and to possess in some degree both scientific and practical interest and value. With consideration of the intense activity now being manifested in the truly scientific study of the constituents of essential oils, it may also serve to indicate the deficiencies of existing knowledge in many directions, and thus incite to further careful research in this interesting and fruitful branch of science.

FRITZSCHE BROTHERS.

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PART I.

OFFICIAL ESSENTIAL OILS.

Recognized by the Pharmacopœia of the United States of America.
Seventh Decennial Revision, 1890.

Oil of Allspice, see Oil of Pimenta.

Oil of American Wormseed, see Oil of Chenopodium.

Oil of Anise.

Oleum Anisi.

(German: Anis-Oel.)

Distilled from the fruit of *Pimpinella Anisum* Linné (Nat. Ord. *Umbelliferae*).

"A colorless or pale yellow liquid, having a characteristic, aromatic odor and taste. Specific gravity 0.980 to 0.990 at 17° C."* Its optical rotation is very slightly to the left. "At a temperature usually between 10° and 15° C. (14° to 19°, Schimmel & Co.) it solidifies to a white, crystalline mass." The chief portion of the oil, over 90 per cent., consists of anethol $C_{10}H_{12}O$ (see the latter, under Chemical Preparations, Part III). The chemical character of the other constituent of the oil, which is liquid at ordinary temperatures, has not yet been determined, but it is apparently a terpene.

Oil of Anise is used medicinally as an aromatic carminative and stimulant, and also for imparting flavor to liquors.

Oil of Bay, see Oil of Myrcia.

Oil of Bergamot.

Oleum Bergamottæ.

(German: Bergamott-Oel.)

Obtained by expression from the rind of the fresh fruit of *Citrus Bergamia* Risso et Poiteau (Nat. Ord. *Rutaceæ*).

"A greenish or greenish-yellow liquid, having a peculiar, very fragrant odor, and an aromatic, bitter taste. Specific gravity 0.880 to 0.885" (0.883 to 0.886, Schimmel & Co.). "Its optical rotation should not be more than 20° to the right in a 100 Mm. tube." The rotation of a pure oil usually varies from +9° to +15°. (See Schimmel & Co.'s *Bericht*, April, 1893, p. 19, and April, 1894, p. 21.) "It is

* The quotation marks in the text of the official essential oils and chemicals denote the portions abstracted from the text of the U. S. Pharmacopœia.

soluble at 20° C. in 1.5 to 2 volumes of alcohol of 80 per cent. by volume. If about 2 grammes of the oil be evaporated in a capsule, on a water bath, until the odor has completely disappeared, a soft, green, homogeneous residue should be left, amounting to not more than about 6 per cent. of the oil (absence of *fatty oils*). The oil contains limonene, dipentene, linalool and linaloyl acetate, the latter in amounts of about 36 to 39 per cent.

The substance deposited from freshly expressed Oil of Bergamot is termed *bergapten*. It forms colorless, needle-shaped crystals, of the composition $C_{12}H_8O_4$, or $C_{11}H_8O_2 < \begin{smallmatrix} O \\ | \\ CO \end{smallmatrix}$, which fuse at 188° C. It is the lactone or inner anhydride of bergaptenic acid $C_{11}H_8O_2 < \begin{smallmatrix} OH \\ | \\ COOH \end{smallmatrix}$. By fusion with potassium hydroxide it affords phloroglucin $C_6H_3(OH)_3$. (*Monatshefte für Chemie*, 1891, p. 379, and 1893, p. 28.)

The value of Oil of Bergamot depends chiefly on the amount of linaloyl acetate which it contains, and this may be determined by the method described under Oil of Lavender Flowers.

Oil of Bergamot is used chiefly in perfumery, for perfuming soaps, etc.

Oil of Betula.

Oleum Betulæ Volatile.

[Oil of Sweet Birch.]

(German: Birkenrinden-Oel.)

Distilled from the bark of *Betula lenta* Linné, the so-called Sweet Birch, Cherry Birch or Black Birch (Nat. Ord. *Cupuliferae*).

A colorless or yellowish liquid, having a characteristic, strongly aromatic odor and taste, closely resembling that of gaultheria or wintergreen. Specific gravity 1.180 to 1.185. It is optically inactive, and practically identical with methyl salicylate. The *crude* oil appears to contain traces of an undetermined substance, which imparts to it an odor slightly different from perfectly pure methyl salicylate. (See *Oil of Wintergreen*, *Synthetic*; also *Oil of Gaultheria*.)

The Oil of Betula or Sweet Birch represents the chief portion of the so-called Natural Oil of Wintergreen of commerce. It is sometimes adulterated with petroleum and other substances, which, in connection with the above described characters, may readily be detected by the official tests mentioned under Oil of Wintergreen, *Synthetic*.

Oil of Betula is used chiefly as a flavoring agent.

Oil of Bitter Almond.

Oleum Amygdalæ Amarae.

(German: Bitter-Mandel-Oel.)

Obtained from Bitter Almond, the seed of *Prunus Amygdalus* var. *amara* De Candolle (Nat. Ord. *Rosaceae*), by maceration with water, and subsequent distillation.

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"A clear, colorless or yellowish, thin and strongly refractive liquid, having a characteristic, aromatic odor, and a bitter and burning taste. Specific gravity 1.060 to 1.070 (1.045 to 1.060, Schimmel & Co.). Boiling point about 180° C. It is optically inactive." It consists of benzaldehyde C_6H_5-COH , and hydrocyanic acid HCN . By exposure to the air the benzaldehyde becomes oxidized to benzoic acid, and this change takes place more quickly when the oil has been deprived of its hydrocyanic acid.

Oil of Bitter Almond, when its distillation has been properly conducted, contains on an average from 1.5 to 4 per cent. of hydrocyanic acid. A higher specific gravity than that recognized by the Pharmacopœia would indicate an excessive and even dangerous amount of hydrocyanic acid. Thus, Messrs. Schimmel & Co. (*Bericht*, April, 1893, p. 41) have met with oils having the following remarkably high specific gravities and percentages of hydrocyanic acid ;

Specific gravity.....	1.086	1.088	1.088	1.093	1.096
HCN.....	8.917%	8.38%	9.85%	10.07%	11.37%

while normal oils of their own distillation had the following characters:

Specific gravity.....	1.052	1.053	1.054	1.058
HCN.....	1.68%	1.60%	3.74%	1.713%

Benzaldehyde combines with hydrocyanic acid to form the cyanhydrin, or the nitrile of mandelic acid $C_6H_5-CH(OH)-CN$, a body having a specific gravity of 1.124, and which is therefore contained in the oil of bitter almond. (See *Bericht*, *loc. cit.*)

For the detection of *artificial oil containing chlorinated products*, as also adulterations with *other volatile oils* or *nitrobenzol*, reference may be made to the tests of the U. S. Pharmacopœia.

Another test for the detection of artificial oil, which commends itself for its simplicity and rapidity of execution, and which we believe to be perfectly reliable, if carefully conducted, is as follows: A piece of strong, clean copper wire, with a looped end, is held in a non-luminous flame, such as that of the ordinary Bunsen burner or alcohol lamp, until no color is imparted to the flame, and then permitted to cool. A drop or two of the oil to be tested is then allowed to fall on the looped end of the wire, avoiding any contact of the latter with the fingers, and the oil subsequently ignited and left to burn outside of the flame. The looped end of the wire is now slowly brought in contact with the lower outer edge of the flame. If the oil is *artificial* it will at once impart a distinct, but quite transient, green tinge to the flame, caused by the vapor of the chloride of copper formed, while a pure *natural oil* will produce at the most but a slight yellow color.

The medicinal action of oil of bitter almond is similar to that of hydrocyanic acid, and it is given in doses of from one-fourth to one drop. It is also used to impart its peculiar flavor to various mixtures. Great care should be exercised in its use, as when taken in any considerable amount it acts as a powerful poison, and even the oil deprived of hydrocyanic acid has a marked physiological action, especially on the nervous system.

Oil of Cade.

Oleum Cadinum.

(German: Kade-Oel or Radi-Oel.) [Oleum Juniperi Empyreumaticum.]

A product of the dry distillation of the wood of *Juniperus oxycedrus* Linné (Nat. Ord. *Coniferae*).

"A brownish or dark brown, clear, thick liquid, having a tarry odor, and an empyreumatic, burning taste. Specific gravity about 0.990." The oil contains phenols, and a sesquiterpene termed cadinene $C_{15}H_{24}$, the latter boiling at 274 to 275° C. (Liebig's *Annalen*, 238, p. 82).

Oil of Cade is used externally in cutaneous affections.

Oil of Cajuput.

Oleum Cajuputi.

(German: Cajeput-Oel.)

Distilled from the leaves of *Melaleuca Leucadendron* Linné (Nat. Ord. *Myrtaceae*).

"A thin, bluish-green, or, after rectification, colorless liquid, having a peculiar, agreeable, distinctly camphoraceous odor, and an aromatic, bitterish taste. Specific gravity 0.922 to 0.929" (0.920 to 0.930, Schimmel & Co.). It deviates polarized light slightly to the left. The oil contains cineol, terpeneol, and one or more terpenes. The green color of the oil is usually due to traces of copper.

Oil of Cajuput is used medicinally, internally as a stimulant, diaphoretic and vermifuge, and externally as a local stimulant and rubefacient.

Oil of Caraway.

Oleum Cari.

(German: Kümmel-Oel.)

Distilled from the fruit of *Carum Carvi* Linné (Nat. Ord. *Umbelliferae*).

"A colorless or pale yellow, thin liquid, having the characteristic aromatic odor of caraway, and a mild, spicy taste. Specific gravity 0.910 to 0.920" (0.905 to 0.915, Schimmel & Co.). Optical rotation +75° to +85°. It contains dextrogyrate limonene (formerly known as *carvene*) and dextrogyrate carvol, both of which are more fully described under Chemical Preparations, Part III.

Oil of Caraway is used medicinally as an aromatic stimulant and carminative, and also to impart flavor to liquors and other mixtures.

Oil of Cassia, see Oil of Cinnamon.**Oil of Chenopodium.****Oleum Chenopodii.**

[Oil of American Wormseed.]

(German: Chenopodium-Oel.)

Distilled from the fruit of *Chenopodium ambrosioides* Linné, var. *anthelminticum* Gray (Nat. Ord. *Chenopodiaceae*).

“A colorless or yellowish liquid, having a characteristic, penetrating odor, and a pungent and bitterish taste. Specific gravity about 0.970.” The characters of this oil are subject to considerable variation, which appear to depend chiefly upon its age. Thus commercial oils from reliable sources we have found to have the specific gravity 0.970, optical rotation $-5^{\circ} 35'$ to $-6^{\circ} 20'$, and to form a clear solution with ten times their volume of 70 per cent. alcohol, while an oil distilled in our Garfield factory has, in its fresh state, a specific gravity of 0.910, an optical rotation of $-18^{\circ} 55'$, and does not form a perfectly clear solution with ten times its volume of 70 per cent. alcohol. The oil is stated to consist of a hydrocarbon $C_{10}H_{16}$, and a body of the composition $C_{10}H_{16}O$ (*Amer. Journ. Pharm.*, xxvi, p. 405), but is deserving of more thorough examination.

Oil of Chenopodium is used chiefly as an anthelmintic.

Oil of Chenopodium Leaves, which is not official, has also been distilled in our Garfield factory. It has a yellowish color and an odor strongly resembling the oil from the fruit. The freshly distilled oil has a specific gravity of 0.879, and an optical rotation of $-32^{\circ} 55'$. It is insoluble in 70 per cent. alcohol.

Oil of Cinnamon.**Oleum Cinnamomi.**

[Oil of Cassia.]

(German: Cassia-Oel.)

Distilled from undetermined species of *Cinnamomum* (Nat. Ord. *Laurineae*), grown in China.

“A yellowish or brownish liquid, becoming darker and thicker by age and exposure to the air, having the characteristic odor of cinnamon, and a sweetish, spicy and burning taste. Specific gravity 1.055 to 1.065.” It consists chiefly of cinnamic aldehyde C_8H_7-COH , with some cinnamyl acetate $C_9H_9-C_2H_3O_2$.

The official or commercial Oil of Cassia appears to be obtained chiefly from the leaves, or from the latter mixed with leaf stems and young twigs. (See Schimmel & Co.'s *Bericht*, October, 1892, p. 12.) It was formerly much adulterated with resin, petroleum, fatty oils, etc., which may be detected by the tests given in the U. S. Pharmacopœia. The best criterion of the value of the oil is the determination of the amount of cinnamic aldehyde, which should not be less than 75 per

cent. This can be accomplished by bringing 10 Cc. of the oil, measured by a pipette, into a glass flask having a capacity of about 100 Cc., and provided with a narrow neck about 13 Cm. long and 8 Mm. inside diameter, which is graduated in tenths of a cubic centimeter. A small amount of solution of sodium bisulphite, containing about 30 per cent. of the salt, is then added to the oil, and the mixture agitated, when a semi-solid mass will be formed. The flask is now placed in a bath of boiling water, and, when the mixture is completely liquefied, a further amount of the bisulphite solution is added until the flask is about three-fourths full. The mixture is again heated in the water bath, with frequent agitation, until all the solid particles have become dissolved, and there is obtained a clear, oily liquid floating on the surface of the aqueous solution. Finally, so much bisulphite solution is added that the oily layer, which represents the non-aldehyde bodies, will rise completely in the upper part of the neck of the flask. After cooling, the volume of the non-aldehydes is deducted from the 10 Cc. of oil originally used, and the remainder, when multiplied by 10, will indicate the percentage amount (by volume) of cinnamic aldehyde contained in the oil.

Oil of Cinnamon is used chiefly for imparting its agreeable flavor to other mixtures, and for perfuming ordinary soaps, etc.

In order to determine the character of the oils afforded by different parts of the plant yielding Cassia Cinnamon, Messrs. Schimmel & Co. have distilled from authentic crude material the following products. (See *Bericht*, October, 1892, p. 13):

Oil of Cassia Bark.

Specific gravity 1.035. Contains 88.9 per cent. of cinnamic aldehyde.

Oil of Cassia Buds.

Specific gravity 1.026. Contains 80.4 per cent. of cinnamic aldehyde.

Oil of Cassia Bud Stems.

Specific gravity 1.046. Contains 92 per cent. of cinnamic aldehyde.

Oil of Cassia Leaves (with leaf stems and young twigs).

Specific gravity 1.055. Contains 93 per cent. of cinnamic aldehyde.

The above figures represent the results of single distillations, and in a more extended series of observations some variations would doubtless be found. (See *Bericht*, April, 1894, p. 13.)

The following non-official, but closely related cinnamon oils, may also conveniently be considered here:

Oil of Cinnamon, Ceylon.

(German: Ceylon Zimmt-Oel.)

Distilled from the bark of *Cinnamomum Zeylanicum* Breyn (Nat. Ord. *Laurineæ*). A pale yellow liquid, having the characteristic odor of cinnamon, and a sweetish, burning, and spicy taste. Specific gravity 1.025 to 1.035. It consists chiefly of cinnamic aldehyde, with some eugenol and phellandrene.

The bark of *Cinnamomum Wightii* Meissn., of Northern India, yields a highly aromatic oil, having a specific gravity of 1.01, and boiling between 130° and 170° C.

Oil of Cinnamon Leaves.

(German: Zimmtblätter-Oel.)

Distilled from the leaves of *Cinnamomum Zeylanicum* Breyn (Nat. Ord. *Laurineæ*). A pale yellow, limpid liquid, having a combined cinnamon and clove-like odor. Specific gravity 1.044 to 1.060. It contains cinnamic aldehyde, eugenol, and safrol.

Oil of Cinnamon Root.

(German: Zimmtwurzel-Oel.)

Distilled from the bark of the root of *Cinnamomum Zeylanicum* Breyn (Nat. Ord. *Laurineæ*).

A nearly colorless liquid, having a remarkably strong odor of common camphor, which partially separates from the oil at ordinary temperatures.

Oil of Cloves.

(German: Nelken-Oel.)

Distilled from cloves, the unexpanded flowers of *Eugenia aromatica* (Linné) O. Kuntze (Nat. Ord. *Myrtaceæ*).

“A pale yellow, thin liquid, becoming darker and thicker by age and exposure to the air, having a strongly aromatic odor of cloves, and a pungent and spicy taste. Specific gravity 1.060 to 1.067” (1.060 to 1.070, Schimmel & Co.). It deviates polarized light slightly to the left. It boils between 250° and 260° C., the greater part distilling over between 250° and 251° C. “1 Cc. of the oil should form a clear solution with 2 Cc. of a mixture of 2 volumes of alcohol and 1 volume of water (absence of *petroleum*, *most fatty oils*, *oil of turpentine*, etc.).” The oil contains eugenol, about 80 to 90 per cent. (see the latter, under Chemical Preparations, Part III), and a sesquiterpene $C_{15}H_{24}$, termed caryophyllene, which boils at about 255° C. (Liebig's *Annalen*, 271, p. 285).

Oleum Caryophylli.

For the estimation of engenol in the form of its benzoyl compound, see *Pharm. Centralhalle*, 1891, p. 589; also *Amer. Journ. Pharm.*, 1892, p. 26, and Schimmel & Co.'s *Bericht*, April, 1892, p. 28.

Oil of Cloves is a powerful aromatic, and also possesses antiseptic properties. It is used medicinally, both internally and externally, especially to allay the pain of carious teeth, and also for imparting its peculiar flavor to other mixtures.

Oil of Clove Stems has a specific gravity of 1.055 to 1.065. It may be distinguished by its odor, which is not so fine as that of true Oil of Cloves.

Oil of Copaiba.

Oleum Copaibæ.

(German: Copaivabalsam-Oel.)

Distilled from Copaiba, or the so-called Balsam of Copaiba, the oleoresin of *Copaiba Langsdorffii* (Desfontaines) O. Kuntze, and of other species of *Copaiba* (Nat. Ord. *Leguminosæ*).

"A colorless or pale yellowish liquid, having the characteristic odor of copaiba, and an aromatic, bitterish and pungent taste. Specific gravity 0.890 to 0.910" (0.900 to 0.910, Schimmel & Co.). It deviates polarized light to the left; an oil distilled in our Garfield factory showing an optical rotation of -8° 6. The oil consists chiefly of caryophyllene $C_{15}H_{24}$.

Oil of Copaiba is considered to have the same effects on the system as Copaiba.

Oil of Coriander.

Oleum Coriandri.

(German: Coriander-Oel.)

Distilled from the fruit of *Coriandrum sativum* Linné (Nat. Ord. *Umbelliferae*).

"A colorless or slightly yellowish liquid, having the characteristic, aromatic odor of coriander, and a warm, spicy taste. Specific gravity 0.870 to 0.885" (0.874 to 0.882, Schimmel & Co.). Optical rotation $+4^{\circ}$ to $+13^{\circ}$. "1 Cc. of the oil should form a clear solution with 3 Cc. of a mixture of 3 volumes of alcohol and 1 volume of water." This test will serve to detect adulterations with oil of sweet orange peel, oil of turpentine, etc. The oil contains linalool (formerly termed *coriandrol*) and pinene.

Oil of Coriander is aromatic and carminative, and is often used to correct the odor and taste of other mixtures.

Oil of Cubeb.

Oleum Cubebæ.

(German: Cubeben-Oel.)

Distilled from the unripe fruit of *Piper Cubeba* Linné filius (Nat. Ord. *Piperaceæ*).

"A colorless, pale greenish or yellowish liquid, having the characteristic odor of cubeb, and a warm, camphoraceous, aromatic taste. Specific gravity about 0.920" (0.910 to 0.930, Schimmel & Co.). The oil consists chiefly of cadinene $C_{15}H_{24}$, with some dipentene, and, when old, or distilled from old fruit, contains cubeb camphor $C_{15}H_{24} \cdot H_2O$.

Oil of Cubeb possesses the aromatic property of the fruit, and when taken internally produces symptoms similar to oil of copaiba.

Oil of Erigeron.

[Oil of Fleabane.]

(German: Erigeron-Oel.)

Distilled from the fresh, flowering herb of *Erigeron canadense* Linné (Nat. Ord. *Compositæ*).

"A pale yellow, limpid liquid, becoming darker and thicker by age and exposure to the air, having a peculiar, aromatic, persistent odor, and an aromatic, slightly pungent taste. Specific gravity about 0.850, increasing with age" (0.855 to 0.890, Schimmel & Co.). The larger part of the oil distills between 175° and 180° C. It consists chiefly of dextrogyrate limonene, together with a substance which readily becomes decomposed or polymerized by the action of heat, and which can therefore not be distilled under ordinary pressure. (See *Ber. d. deutsch. chem. Ges.*, 15, 1882, p. 2854; *Amer. Journ. Pharm.*, 1883, p. 372; Liebig's *Annalen*, 227, p. 292; *Pharm. Rundschau*, 1887, p. 201; and *Proc. Wis. Pharm. Assoc.*, 1893, p. 65.)

Oil of Erigeron has been employed medicinally for controlling uterine hemorrhage, and is supposed to act very much like the oil of turpentine, although much less irritant and stimulating.

Oil of Eucalyptus.

(German: Eucalyptus-Oel.)

Distilled from the fresh leaves of *Eucalyptus globulus* Labillardière, *Eucalyptus oleosa* F. von Mueller, and some other species of *Eucalyptus* (Nat. Ord. *Myrtaceæ*).

"A colorless or faintly yellowish liquid, having a characteristic, aromatic, somewhat camphoraceous odor, and a pungent, spicy and cooling taste. Specific gravity 0.915 to 0.925. If 1 Cc. of the oil be mixed with 2 Cc. of glacial acetic acid, and 1 or 2 Cc. of a saturated, aqueous solution of sodium nitrite be gradually added, the mixture, when gently stirred, should not form a crystalline mass (distinction from oils of Eucalyptus containing a considerable proportion of phellandrene)." The test for phellandrene is rendered somewhat more delicate by the following method of procedure: 1 Cc. of the oil is mixed with 5 Cc. of petroleum benzin, 1 or 2 Cc. of a concentrated solution of sodium nitrite added, and subsequently glacial acetic acid

Oleum Eucalypti.

added, a drop or two at a time, with vigorous agitation after each addition. If phellandrene be present in any considerable amount its crystalline nitrite, $C_{10}H_{16}N_2O_3$, will separate from the benzin solution.

Oil of Eucalyptus globulus has an optical rotation of $+1^\circ$ to $+20^\circ$, and contains cineol (eucalyptol), dextrogyrate pinene, and small amounts of valeric, butyric and capronic aldehydes.

Oil of Eucalyptus oleosa has an optical rotation of -3° to -5° , and contains cineol and cuminol.

Both of these oils have strongly antiseptic properties, which are due to the cineol (eucalyptol) contained therein, and are also used medicinally in asthmatic and bronchial affections. (See also Eucalyptol, under Chemical Preparations, Part III.)

In connection with the above, the following Eucalyptus Oils, which have either been distilled or examined by Messrs. Schimmel & Co., possess considerable interest:

Oil of Backhausia citriodora. Has a lemon- and verbena-like odor. Specific gravity 0.900. Boils between 223° and 233° C. It contains citral.

Oil of Eucalyptus amygdalina. Specific gravity 0.860 to 0.890. Optical rotation -27° to -68° . Boils between 170° and 180° C. It contains phellandrene and cineol.

Oil of Eucalyptus Bayleyana. Specific gravity 0.940. Boils between 160° and 185° C. It contains cineol and a terpene.

Oil of Eucalyptus citriodora. Specific gravity 0.870. Optically inactive.

Oil of Eucalyptus dealbata. Has a fine melissa-like odor. Specific gravity 0.885 from fresh, and 0.946 from dry leaves. Boils between 206° and 216° C.

Oil of Eucalyptus Haemastoma. Has an odor reminding of cumin oil. Specific gravity 0.890. Boils between 170° and 250° C. It contains cymol, cumin aldehyde, and possibly menthone.

Oil of Eucalyptus maculata. Has a melissa-like odor. Specific gravity 0.900. Boils between 210° and 220° C. It contains citronellal $C_{10}H_{18}O$, and possibly geraniol.

Oil of Eucalyptus maculata, var. citriodora. Has a fine melissa-like odor. Specific gravity 0.870 to 0.905. Slightly dextrogyrate. Boils between 209° and 220° C. It contains citronellal (citronellone) $C_{10}H_{18}O$, and geraniol $C_{10}H_{18}O$.

Oil of Eucalyptus microcorys. Specific gravity 0.935. Boils between 160° and 200° C. It contains cineol.

Oil of Eucalyptus odorata. Specific gravity 0.907. It contains cineol and cuminol.

Oil of Eucalyptus rostrata. Specific gravity 0.924. Optical rotation $+12^{\circ} 58'$. It contains cineol and valeric aldehyde.

Oil of Eucalyptus Staigeriana. Has a lemon-like odor. Specific gravity 0.883. Boils between 223° and 233° C. It contains citral.

Oil of Fennel.

Oleum Fœniculi.

(German: Fenchel-Oel.)

Distilled from the fruit of *Fœniculum capillaceum* Gilibert (Nat. Ord. *Umbellifere*).

"A colorless or pale yellowish liquid, having the characteristic, aromatic odor of fennel, and a sweetish, mild and spicy taste. Specific gravity not less than 0.960" (usually between 0.965 and 0.975, Schimmel & Co.). Its optical rotation varies between $+7^{\circ}$ and $+22^{\circ}$. "Between 5° and 10° C. it usually solidifies to a crystalline mass, but occasionally it remains liquid at a considerably lower temperature." The higher the temperature at which crystals of anethol separate, the better is the quality of the oil. It contains pinene, phellandrene, dipentene, fenchone $C_{10}H_{16}O$, and anethol $C_{10}H_{12}O$, the latter usually in amounts of about 60 per cent. (Compare Oil of Anise.) The Oil of Fennel from different sources never contains all these constituents at the same time. Some, for example, contain no phellandrene, others no fenchone, and still others may contain no anethol.

The medicinal action of Oil of Fennel is similar to that of Oil of Anise.

Oil of Fleabane, see Oil of Erigeron.

Oil of Gaultheria.

Oleum Gaultheriæ.

[Oil of Wintergreen.]

(German: Wintergreen-Oel.)

Distilled from the leaves of *Gaultheria procumbens* Linné (Nat. Ord. *Ericaceæ*), known also as *Checkerberry*, *Partridge-berry* or *Boxberry*.

"A colorless or yellow, or occasionally reddish liquid, having a characteristic, strongly aromatic odor, and a sweetish, warm and aromatic taste. Specific gravity 1.175 to 1.185. Boiling point 218° to 221° C. It deviates polarized light slightly to the left." Oils distilled in our Garfield factory we have found to vary in optical rotation from $-0^{\circ} 22'$ to -1° . The oil consists chiefly of methyl salicylate, with a fraction of 1 per cent. of another substance which has a peculiar odor, a viscid consistence, and high boiling point, and which is decomposed by distillation under ordinary pressure. The composition of the latter substance, which has been assumed to be a sesquiterpene, has not yet been determined with sufficient accuracy. (See *Pharm. Rundschau*, 1889, p. 283; 1890, p. 38; also *Amer. Journ. Pharm.*, 1889, p. 398; 1890, p. 9.)

Although Oil of Gaultheria is still accorded independent recognition by the U. S. Pharmacopœia, with probable deference to the more conservative members of the profession, it is, nevertheless, a well known and recognized fact that most of the so-called *Natural Oil of Wintergreen* of commerce consists of the closely related Oil of Sweet Birch (see *Oil of Betula*), and that both of these natural products are constantly becoming more and more displaced by a pure, synthetic *Methyl Salicylate* (see *Oil of Wintergreen, Synthetic*). Under the latter article will be found the important official tests for purity, which are equally applicable to the above mentioned natural oils.

Oil of Hedeoma.

Oleum Hedeomæ.

[Oil of American Pennyroyal.]

(*German*: Poley-Oel, Amerikanisches.)

Distilled from the leaves and tops of *Hedeoma pulegioides* (Linné) Persoon (Nat. Ord. *Labiatae*).

“A pale yellowish, limpid liquid, having a characteristic, pungent, mint-like odor and taste. Specific gravity 0.930 to 0.940.” An oil distilled and rectified in our Garfield factory shows an optical rotation of $+18^{\circ} 43'$, and a commercial oil from a reliable source $+21^{\circ} 20'$.

The oil has been chemically examined by E. Kremers (*Proc. Amer. Pharm. Assoc.*, 1887, pp. 546–561), who found, after saponification with alcoholic potassa, an alcohol of relatively low boiling point, two bodies of the composition $C_{10}H_{18}O$, boiling at 168° to 171° C., and 206° to 209° C. respectively, together with formic, acetic, and iso-heptoic acids. The bodies $C_{10}H_{18}O$ were subsequently recognized as ketones, the higher boiling one being apparently menthone. It has also been shown more recently that the oil contains pulegone $C_{10}H_{16}O$, and considered that the ketones previously mentioned represent the reduction products of the latter. (*Pharm. Rundschau*, 1891, p. 130, and *Proc. Wis. Pharm. Assoc.*, 1892, p. 55; 1893, p. 51.)

An important test for the purity of this oil is its property of forming a clear solution with twice its volume of 70 per cent. alcohol.

Oil of Hedeoma has the properties of an aromatic stimulant, carminative and emmenagogue. (Compare *Oil of European Pennyroyal*, below.)

The following non-official oil, on account of its relationship with the preceding, may appropriately be considered here:

Oil of European Pennyroyal.

(*German*: Poley-Oel.)

Distilled from the herb of *Mentha Pulegium* Linné (Nat. Ord. *Labiatae*).

The oil has a yellowish or yellowish-green color, and a strongly aromatic, mint-like odor. Specific gravity 0.935 to 0.955. Optical rotation $+18^{\circ}$ to $+23^{\circ}$. The chief portion of the oil distills between 212° and 216° C., and contains pulegone, a ketone of the composition $C_{10}H_{16}O$. The latter is a colorless liquid, having an agreeable odor, reminding somewhat of peppermint, boils at 130° to 131° C. under a pressure of 60 Mm., has a specific gravity of 0.9323 at 20° C., and optical rotation of $+21^{\circ} 16'$. (Liebig's *Annalen*, Bd. 262, pp. 1-37, and Bd. 277, p. 160.)

This oil, like the Oil of Hedeoma, is soluble in twice its volume of alcohol of 70 per cent. by volume, and also appears to possess analogous medicinal properties.

Oil of Juniper.

Oleum Juniperi.

(German: Wachholderbeer-Oel.)

Distilled from the fruit of *Juniperus communis* Linné (Nat. Ord. *Coniferae*).

"A colorless or faintly greenish-yellow liquid, becoming darker and thicker by age and exposure to the air, having the characteristic odor of juniper, and a warm, aromatic, somewhat terebinthinate and bitterish taste. Specific gravity 0.850 to 0.890" (0.865 to 0.885, Schimmel & Co.). It is optically either dextrogyrate, lævogyrate or sometimes inactive. It consists chiefly of pinene, with some cadinene $C_{15}H_{24}$, and an undetermined substance, probably an ester, to which the peculiar juniper-like odor and taste are due.

Oil of Juniper is used medicinally as a stimulant, carminative and diuretic, but is chiefly employed in the preparation of certain liquors.

Oil of Juniper, Empyreumatic, see Oil of Cade.

Oil of Lavender Flowers. Oleum Lavandulae Florum.

(German: Lavendel-Oel.)

Distilled from the fresh flowers of *Lavandula officinalis* Chaix (Nat. Ord. *Labiatae*).

"A colorless or yellowish liquid, having the fragrant odor of lavender flowers. Specific gravity 0.885 to 0.897" (0.883 to 0.890, Schimmel & Co.). Optical rotation -5° to -8° . The oil contains linalool, linaloyl acetate, geraniol, and a very small amount of cineol. The presence of the latter in any considerable amount would indicate a contamination with the Oil of Spike Lavender (see below).

The oil should form a clear solution with three times its volume of 70 per cent. alcohol.

The value of Oil of Lavender Flowers depends chiefly upon the amount of ester or linaloyl acetate which it contains, and which should

not be less than 30 to 35 per cent. (See Schimmel & Co.'s *Bericht*, April, 1893, p. 36, and April, 1894, p. 36.) This estimation may be accomplished by the following method:

(a) *Determination of the Ester in Oil of Lavender Flowers.*

About 5 grammes of the oil are accurately weighed in a strong glass bottle having a capacity of about 100 Cc., then 25 Cc. of alcoholic normal solution of sodium hydrate added, the bottle tightly corked, and allowed to stand for an hour in a bath of boiling water. After cooling, the free alkali is titrated, in the same bottle, with normal sulphuric acid, with the use of phenol-phthalein as an indicator. The number of cubic centimeters of alkali required for the saponification of the oil, when multiplied by the decimal 0.196, will indicate the amount of ester, calculated as linaloyl acetate $C_{10}H_{17}-C_2H_3O_2$, contained in the weight of oil employed.

(b) *Determination of the free Linalool in Oil of Lavender Flowers.*

Into a long-necked flask, or one provided with a long glass tube, one end of which is so expanded and ground as to form a tightly fitting stopper for the flask, are brought about 10 Cc. of the oil, together with 10 Cc. of acetic anhydride and 2 grammes of fused sodium acetate, and the mixture kept in a state of gentle ebullition for two hours. After cooling, the mixture is shaken with 100 Cc. of water, and the separated oil washed by agitation with a 5 per cent. solution of sodium hydrate, being careful, by the gradual addition of the latter, to avoid any considerable elevation of temperature. This washing is continued until, even after agitating the liquid for some time, it still retains a slightly alkaline reaction. The oil is subsequently washed with several successive portions of pure water, and, after separation, it is dried by contact with calcium chloride, and filtered.

Of this etherified oil, containing the linalool in the form of its acetic ester, about 5 grammes are accurately weighed, saponified, and titrated in precisely the same manner as described under (a). The amount of free linalool which may be calculated from the difference between the ester determinations (a) and (b) does not accurately represent the amount actually contained in the oil, the latter being considerably greater, but the results, nevertheless, form a valuable basis for comparison.

Oil of Lavender Flowers is used chiefly for its agreeable perfume.

The following non-official Oils of Lavender may appropriately be considered here:

Oil of Lavandula dentata Linné. Has a specific gravity of 0.926, and distills almost completely between 170° and 200° C.

Oil of Lavandula Stoechas Linné. Has a specific gravity of 0.942, and distills between 180° and 245° C. Both of these oils have an odor reminding of rosemary and camphor, and contain cineol.

Oil of Lavender, Spike.

(German: Spick-Oel.)

Distilled from the flowering herb of *Lavandula spica* D. C. (Nat. Ord. *Labiatae*).

This oil is much less fragrant than the official Oil of Lavender Flowers, having an odor reminding of both rosemary and lavender, and it also differs in composition from the official oil. A pure oil should have the following characters: Specific gravity 0.905 to 0.920. Optical rotation 0° to +3°. It should form at 20° C. a clear solution with three times its volume of 70 per cent. alcohol. This test is of special importance for detecting adulterations with oil of turpentine. The oil contains pinene, camphene, cineol, linalool, camphor, borneol, and possibly terpineol and geraniol. (*Compt. rend.*, 106, p. 551; 117, pp. 53, 1094.)

It is used chiefly in veterinary medicine, for liniments, etc.

Oil of Lemon.

Oleum Limonis.

(German: Citronen-Oel.)

Obtained by expression from fresh Lemon Peel, the rind of the recent fruit of *Citrus Limonium* Risso (Nat. Ord. *Rutaceae*).

“A pale yellow, limpid liquid, having the fragrant odor of lemon, and an aromatic, somewhat bitterish taste. Specific gravity 0.858 to 0.859 (0.857 to 0.860, Schimmel & Co.). Its optical rotation should not be less than 60° to the right in a 100 Mm. tube.” The rotation of a pure oil usually varies from +60° to +64°. (See Schimmel & Co.’s *Bericht*, April, 1893, p. 22, and April, 1894, p. 24.) It contains a small amount of pinene, with dextrogyrate limonene, about 7 to 8 per cent. of citral (see the latter, under Chemical Preparations, Part III), and a small amount of citronellal (*Ber. der deutsch. chem. Ges.*, 27, 1894, p. 354).

The determination of the physical constants, specific gravity and optical rotation, is of special importance for establishing the purity of this oil.

Oil of Lemon is used chiefly as a flavoring agent and in perfumery.

Oil of Mustard, Volatile.

Oleum Sinapis Volatile.

(German: Senf-Oel.)

Obtained from Black Mustard, the seed of *Brassica nigra* (Linné) Koch (Nat. Ord. *Cruciferae*), by maceration with water and subsequent distillation.

"A colorless or pale yellow, limpid liquid, having a very pungent and acrid odor and taste. Specific gravity 1.018 to 1.029 (1.02 to 1.032, Schimmel & Co.). Boiling point 148° to 150° C." Optically inactive. It consists chiefly of allyl isosulphocyanate or allyl thiocarbimide $\text{CS}=\text{N}$ (C_3H_5), with traces of carbon disulphide. Its purity may readily be determined by the above mentioned characters, and by the other more extended tests described in the U. S. Pharmacopœia, 1890.

Volatile Oil of Mustard is used chiefly externally, and is an exceedingly powerful irritant and vesicant.

Oil of Myrcia.

[Oil of Bay.]

(German: Bay-Oel.)

Oleum Myrciæ.

Distilled from the leaves of *Myrcia acris* DC. (Nat. Ord. *Myrtaceæ*).

"A yellow or brownish-yellow liquid, having an aromatic, somewhat clove-like odor, and a pungent, spicy taste. Specific gravity 0.975 to 0.990." The characters of this oil vary considerably, and this variation appears to depend upon the season of the year in which the leaves are collected, or upon the age of the latter. From the results of a number of distillations we believe the specific gravity to be more correctly included within the limits of 0.965 and 0.985, being, however, only exceptionally as low as 0.965, and generally ranging between 0.975 and 0.985. Some oils of our own distillation, as well as samples from the West Indies, yield a perfectly clear solution with an equal volume or more of official alcohol, and this appears to be the case when distilled from relatively fresh leaves, while others, sometimes even of higher specific gravity, will afford slightly turbid solutions.

Our experience has also convinced us that the official empirical test with sulphuric acid and dilute alcohol, as proposed by Mr. Geo. M. Beringer (see *Amer. Journ. Pharm.*, 1888, pp. 441-445) for the discrimination or detection in this oil of the oil of cloves and oil of pimenta, is totally unreliable, and no oil should be regarded as impure which fails to conform to this test, if it has otherwise the proper characters.

The oil, according to Mittmann (*Archiv der Pharm.*, 1889, pp. 529-548), contains terpenes, a considerable amount of eugenol, a little of the methyl ether of eugenol $\text{C}_6\text{H}_3(\text{OCH}_3)_2\text{C}_3\text{H}_5$, and apparently a diterpene $\text{C}_{20}\text{H}_{32}$. A further investigation of this oil is now in progress in our Garfield laboratories.

Oil of Myrcia is used as a refreshing perfume or lotion in the form of the popular Bay Rum (*Spiritus Myrciæ*, U. S. P.), or for perfuming soaps.

Oil of Neroli, see Oil of Orange Flowers.

Oil of Nutmeg.

(German: Muskatnuss-Oel.)

Distilled from Nutmeg, the seed of *Myristica fragrans* Houttuyn (Nat. Ord. *Myristicaceae*), deprived of its testa.

"A thin, colorless or pale yellow liquid, becoming darker and thicker by age and exposure to the air, having the characteristic odor of nutmeg, and a warm, spicy taste. Specific gravity 0.870 to 0.900" (0.865 to 0.920, Schimmel & Co.). It consists chiefly of pinene, with probably some dipentene, also myristicol $C_{10}H_{16}O$ and myristicin $C_{12}H_{14}O_3$. (Compare Oil of Mace, Part II.)

Oil of Nutmeg is an aromatic stimulant, but is rarely used medicinally.

Oleum Myristicæ.**Oil of Orange Flowers.**

[Oil of Neroli.]

(German: Orangenblüthen-Oel.)

Distilled from the fresh flowers of the Bitter Orange, *Citrus vulgaris* Risso (Nat. Ord. *Rutaceae*).

"A yellowish or brownish, thin liquid, having a very fragrant odor of orange flowers, and an aromatic, somewhat bitter taste. Specific gravity 0.875 to 0.890." Messrs. Schimmel & Co. have observed commercial oils to have a specific gravity of 0.875 to 0.885, and an optical rotation of $+5^\circ$ to $+10^\circ$. Oils of their own distillation varied in specific gravity from 0.881 to 0.887. The oil contains, according to Semmler (*Ber. d. deutsch. chem. Ges.*, 26, p. 2711), about 20 per cent. of limonene, 30 per cent. of nerolol (a lævogyrate alcohol of the composition $C_{10}H_{18}O$, and closely related to linalool), 40 per cent. of nerolyl acetate and 3 per cent. of geraniol $C_{10}H_{18}O$.

Oil of Orange Flowers is used chiefly as a perfume.

Oleum Aurantii Florum.**Oil of Orange Peel.**

(German: Pomeranzen-Oel.)

Obtained by expression from the fresh peel of either the Bitter Orange, *Citrus vulgaris* Risso, or the Sweet Orange, *Citrus Aurantium* Linné (Nat. Ord. *Rutaceae*).

"A pale yellowish liquid, having the characteristic, aromatic odor of orange, and an aromatic and, when obtained from the bitter orange, somewhat bitter taste. Specific gravity about 0.850 (0.848 to 0.854, Schimmel & Co.). Its optical rotation should not be less than 95° to the right in a 100 Mm. tube." Messrs. Schimmel & Co. have observed good commercial oils to vary in optical rotation from about $+96^\circ$ to $+99^\circ$. (See *Bericht*, April, 1893, p. 25, and April, 1894, p. 26.) The oils from the bitter and the sweet orange possess the same

Oleum Aurantii Corticis.

specific gravity and optical rotation, and both consist chiefly of limonene. Oil of Sweet Orange Peel also contains, according to Semmler (*Ber. d. deutsch. chem. Ges.*, 24, p. 202), a small amount of geranial (citral) and a lower boiling aldehyde. (See also Wallach, *Liebig's Annalen*, Bd. 278, p. 318.)

The determination of the above mentioned physical constants is of special importance for establishing the purity of this oil.

Small amounts of oil expressed in our Garfield factory from Florida oranges showed the following characters:

Oil from "Bittersweet" variety.	Specific gravity 0.856.	Optical rotation +96° 25'
Oil from "Sour" variety.	" " 0.856.	" " +94° 15'

Oil of Orange Peel is used exclusively as a flavoring agent and in perfumery.

The following oils, related to the preceding, are of scientific interest, and their physical characters are therefore briefly noted:

Oil of Mandarin Orange.

(*German*: Mandarininen-Oel.)

Expressed from the fresh peel of *Citrus bigaradia sinensis* Dich. Specific gravity 0.85 to 0.86. Optical rotation about +70°.

It contains citral, and a terpene, which is probably limonene.

Oil of Grape Fruit or Shaddock.

The botanical source of this fruit is the *Citrus decumana* Linné. A small amount of the oil, from fruit grown in Florida, has been expressed and examined in our Garfield factory, and was found to have the following characters: The yield of oil is comparatively small. It has a pale yellow color, and an exceedingly fine odor, resembling quite closely that of the bitter orange. Specific gravity 0.865. Optical rotation +94° 30'. (See also Schimmel & Co.'s *Bericht*, April, 1894, p. 27.)

Oil of Pennyroyal, see Oil of Hedeoma.

Oil of Peppermint.

Oleum Menthæ Piperitæ.

(*German*: Pfefferminz-Oel.)

Distilled from the fresh herb of *Mentha piperita* Smith (Nat. Ord. *Labiatae*).

"A colorless, yellowish, or greenish-yellow liquid, becoming darker and thicker by age and exposure to the air, having the characteristic, strong odor of peppermint, and a strongly aromatic, pungent taste, followed by a sensation of cold when air is drawn into the mouth. Specific gravity 0.900 to 0.920."

For the distinctive color reactions, and the official test for the recognition of dementholized oil, reference may be made to the U. S. Pharmacopœia, 1890.

A quite extended investigation of Oil of Peppermint has been conducted in our Garfield laboratories, with special consideration of the chemical composition of the American oil, and the quantitative estimation of the menthol. The essential results of this investigation are here briefly summarized.

The variations in the physical characters of oils from different sources are shown in the following table:

SOURCE OF OIL.	Specific Gravity at 15° C.	Optical Rotation in 100 Mm. Tube.
1. Our own distillation, from fresh Wayne Co., N. Y., herb.....	0.9130	—30° 0'
2. Our own distillation, from partially dry Wayne Co., N. Y., herb.....	0.9140	—32° 0'
3. Our own distillation, from fresh, wild growing herb (New Jersey).....	0.9150	—22° 55'
4. Oil from Wayne Co., N. Y., new mint, first cutting, 1893.....	0.9110	—32° 30'
5. Oil from Wayne Co., N. Y., from crop of 1892.....	0.9158	—26° 45'
6. Oil from St. Joseph Co., Michigan, new mint, first cutting, 1893.....	0.9135	— 9° 45'
7. Oil from St. Joseph Co., Michigan, new mint, second cutting, 1893.....	0.9083	—19° 30'
8. Oil from Van Buren Co., Michigan, new mint, first cutting, 1893.....	0.9067	—29° 20'
9. Oil from Wayne Co., Michigan, new mint, first cutting, 1893.....	0.9135	—28° 30'
10. Oil from Mississippi.....	0.9250	—13° 40'
11. Saxon Oil, from herb grown and distilled by Schimmel & Co., Leipzig.....	0.9100	—26° 0'
12. Mitcham Oil. Rectified.....	0.9070	—27° 55'
13. Japanese Oil.....	0.9100	—34° 45'
14. Japanese Oil, partially deprived of menthol....	0.9030	—31° 20'

The deportment of the oils on fractional distillation affords an excellent criterion of their character, as oils originally of abnormal composition, as well as those which have been more or less deprived of menthol, or which contain the ordinary adulterants, may thus quite readily be recognized. The results of a single fractionation of 50 Cc. of various oils, conducted under conditions as nearly identical as possible, and with the mercurial column of the thermometer entirely in the vapor, are presented in the following table. The figures represent the number of Cc. of liquid which distilled over at the specified

temperatures, but which would naturally be materially changed by repeated fractionation.

DESIGNATION OF OILS.	To 200° C.	200-205° C.	205-210° C.	210-215° C.	215-220° C.	220-225° C.	225-230° C.	230-235° C.
A.	1.1	1.4	5.6	10.0	12.9	8.0	3.1	2.0
B.	2.2	5.7	9.8	13.3	11.3	2.8	0.5	
C.	0.9	0.3	1.2	6.5	16.2	11.8	4.8	2.4
D.	0.7	0.4	3.4	22.0	17.2	2.1	1.0	
E.	0.5	1.6	10.2	20.7	12.0	3.3	...	
F.	1.4	0.7	12.2	24.7	8.6	...		

A represents the average of the figures obtained from quite a series of American oils, which agreed very closely among themselves, as also with the oil of our own distillation, and to a certain extent represent the normal types of *American Peppermint Oil*.

B represents the average of the figures obtained from three *Michigan Oils*, indicated in the preceding table by the numbers 6, 7 and 8.

C represents a *Mississippi Oil*, denoted in the preceding table as number 10. This is characterized by the remarkably large amount of higher boiling constituents, as also by its high specific gravity.

Although these three groups may be considered to possess some points of similarity, they will be seen to be totally different from the three next following, which are much richer in menthol than the American oils.

D represents a *normal Japanese Oil*.

E represents a *Japanese Oil, partially deprived of menthol*.

F represents a *Rectified Mitcham Oil*.

The results of a chemical investigation, conducted in our Garfield laboratories, have thus far shown that American Oil of Peppermint contains the following bodies:

1. Acetaldehyde,	$\text{CH}_3\text{-COH.}$	Boiling point	20.8° C.
2. Acetic acid,	$\text{CH}_3\text{-COOH.}$	" "	118° "
3. Iso-valeraldehyde,	$(\text{CH}_3)_2\text{CH-CH}_2\text{-COH.}$	" "	92° "
4. Iso-valerianic acid,	$(\text{CH}_3)_2\text{CH-CH}_2\text{-COOH.}$	" "	174° "
5. A liquid acid,	$\text{C}_8\text{H}_{12}\text{O}_2.$	" "	—
6. Pinene,	$\text{C}_{10}\text{H}_{16}.$	" "	155-156° "
7. Phellandrene,	$\text{C}_{10}\text{H}_{16}.$	" "	about 170° "
8. Limonene,	$\text{C}_{10}\text{H}_{16}.$	" "	175-176° "
9. Cincol,	$\text{C}_{10}\text{H}_{18}\text{O.}$	" "	176° "
10. Menthone,	$\text{C}_{10}\text{H}_{18}\text{O.}$	" "	206° "
11. Menthol,	$\text{C}_{10}\text{H}_{19}\text{-OH.}$	" "	215.5° " (corr.).
12. Menthyl acetate,	$\text{C}_{10}\text{H}_{19}\text{-C}_2\text{H}_3\text{O}_2.$	" "	228° " (corr.).
13. " iso-valerianate,	$\text{C}_{10}\text{H}_{19}\text{-C}_5\text{H}_9\text{O}_2.$	" "	—
14. Cadinene,	$\text{C}_{15}\text{H}_{24}.$	" "	about 275° "
15. A lactone,	$\text{C}_{10}\text{H}_{16}\text{O}_2.$	Melting point	23° "

The lactone may be converted into a colorless, well crystallizable oxy-acid $C_{10}H_{18}O_3$, which melts at $93^{\circ} C$.

The hydrocarbon *menthene* $C_{10}H_{18}$, which has been stated to occur in Russian Peppermint Oil, although apparently without sufficient proof, we have not been able to detect in the American oil.

Although the previously mentioned physical characters of Oil of Peppermint, such as specific gravity, optical rotation, and especially its deportment on fractional distillation, or by exposure to cold, may serve as a criterion of the quality of the oil, and were in fact hitherto the only available means of judging of its purity, a much more exact and satisfactory method of valuation is afforded by the quantitative determination of the essential constituent of the oil, which is the menthol. The researches conducted in our Garfield laboratories have led to the formulation of such a method, which is not only quite simple in execution, but also indicates with remarkable accuracy, as controlling experiments with pure menthol have shown, the amount of menthol which is actually contained in the oil.

VALUATION OF OIL OF PEPPERMINT.

Based on the quantitative determination of the menthol.

(a). *Estimation of the menthol contained in the form of ester.*

About 20 grammes of the Peppermint Oil are accurately weighed in a strong glass bottle having a capacity of about 100 Cc. 30 Cc. of alcoholic normal solution of sodium hydrate are then added, the bottle tightly corked, and allowed to stand for an hour in a bath of boiling water. After cooling, the free alkali is titrated, in the same bottle, with normal sulphuric acid, with the use of phenol-phthalein as an indicator.

If there are required for this purpose a Cc. normal acid, and if S represent the weight of oil used, then *the percentage of menthol P contained in the oil in the form of ester* may be calculated by the following formula:

$$P = \frac{15.56 (30 - a)}{S}.$$

(b). *Estimation of the total menthol, free and combined.*

The total liquid obtained in the preceding estimation is thoroughly shaken in a separating funnel with 100 Cc. of water. After the separation of the oil the aqueous liquid is drawn off, and the oil washed in a similar manner by shaking it with three successive portions of water of 100 Cc. each, for the purpose of removing the alcohol. The washed oil, carefully separated from the water, is then brought into a flask having a capacity of 100 to 150 Cc., and provided with a long glass tube, ground at one end to fit the mouth of the flask and serve as a condenser, or otherwise a simple long-necked flask may be used.

To the oil are then added 20 Cc. of acetic anhydride and 2 grammes of fused sodium acetate, and the mixture kept in a state of gentle ebullition for an hour. After cooling, the mixture is shaken with 100 Cc. of water, and the separated oil washed by agitation with a 5 per cent. solution of sodium hydrate, being careful by the very gradual addition of the latter to avoid any considerable rise of temperature. This washing is continued until, even after repeated agitation, the liquid retains a slightly alkaline reaction. The oil is subsequently washed with several successive portions of water, and, after separation, it is dried by contact with calcium chloride, and filtered.

Of this acetylied oil, containing the menthol in the form of its acetic ester, about 8 to 10 grammes are accurately weighed in a strong glass bottle, 50 Cc. of alcoholic normal solution of sodium hydrate added, the bottle tightly corked, and allowed to stand for an hour in a bath of boiling water. After cooling, the free alkali is titrated, in the same bottle, with normal sulphuric acid, with the use of phenolphthalein as an indicator.

If there are required for this purpose b Cc. of normal acid, and if s represent the weight of acetylied oil used, then *the total percentage of menthol P' , free and combined*, may be calculated by the following formula:

$$P' = \frac{(50-b) 15.56}{s-0.0419 (50-b)}.$$

The application of this method to the various oils previously noted has afforded the following results:

DESIGNATION OF OIL.	Menthol in form of Ester.	Total Menthol.
1. Our own distillation, from fresh Wayne Co., N. Y., herb.....	11.03%	52.6%
2. Our own distillation, from partially dry Wayne Co., N. Y., herb.....	13.84%	58.1%
3. Oil from Wayne Co., N. Y., new mint, first cut- ting, 1893.....	8.42%	54.3%
4. Oil from Wayne Co., N. Y., from crop of 1892.	9.14%	49.5%
5. Oil from St. Joseph Co., Michigan, new mint, first cutting, 1893.....	3.56%	32.1%
6. Oil from St. Joseph Co., Michigan, new mint, second cutting, 1893.....	4.15%	35.2%
7. Oil from Van Buren Co., Michigan, new mint, first cutting, 1893.....	6.03%	49.1%
8. Oil from Mississippi.....	11.25%	34.9%
9. Saxon Oil, from herb grown and distilled by Schimmel & Co., Leipsic.....	6.31%	66.8%
10. Mitcham Oil, Rectified.....	4.75%	57.9%
11. Japanese Oil.....	3.46%	75.0%
12. “ “ partially deprived of menthol.....	4.60%	59.6%

Another specimen of Wayne Co., N. Y., oil was found to contain 8.56% of ester and 53.9% of total methol, and a Michigan oil 10.76% of ester and 52.4% of total methol.

These observations would indicate that a good Oil of Peppermint should contain not less than about 50 per cent. of total menthol, and that an oil containing materially less than this amount must be regarded as either originally abnormal or purposely deprived of a portion of its menthol.

The Japanese Oil of Peppermint, although containing a high percentage of menthol, is not adapted for general use on account of possessing a peculiarly bitter and disagreeable taste.

Oil of Peppermint is largely used medicinally as a stimulant and carminative, and externally in rheumatic and neuralgic affections. It is also a popular flavoring agent for confections, cordials, etc.

Oil of Pimenta.

Oleum Pimentæ.

[Oil of Allspice.]

(German: Piment-Oel.)

Distilled from Pimenta, the nearly ripe fruit of *Pimenta officinalis* Lindley (Nat. Ord. *Myrtaceæ*).

“A colorless or pale yellow liquid, becoming darker and thicker by age and exposure to the air. It has a strongly aromatic, clove-like odor, and a pungent and spicy taste. Specific gravity 1.045 to 1.055” (1.04 to 1.05, Schimmel & Co.). 1 Cc. of the oil should form a clear solution with 2 Cc. of a mixture of 2 volumes of alcohol and 1 volume of water (absence of *petroleum*, *most fatty oils*, *oil of turpentine*, etc.). The oil contains eugenol, and a sesquiterpene $C_{15}H_{24}$.

Oil of Pimenta is an aromatic stimulant, closely resembling in composition and properties the Oil of Cloves.

Oil of Rose.

Oleum Rosæ.

(German: Rosen-Oel.)

Distilled from the fresh flowers of *Rosa damascena* Mueller (Nat. Ord. *Rosaceæ*).

“A pale yellowish, transparent liquid, having the strong, fragrant odor of rose, and a mild, slightly sweetish taste. Specific gravity 0.865 to 0.880 at 20° C. (0.855 to 0.865 at 20° C., Schimmel & Co.). The congealing point of the oil is subject to some variation, depending upon the amount of stearopten, but when slowly cooled to a temperature, usually, between 16° and 21° C., it becomes a transparent solid, interspersed with numerous, slender, shining, iridescent, scale-like crystals. Upon the application of the heat of the hand the crystals should float in the upper portion of the liquefied oil.”

The liquid, fragrant portion of Oil of Rose consists for the most part of an alcoholic body of the composition $C_{10}H_{18}O$, which first

received the name of *rhodinol* (Eckart, in *Arch. der Pharm.*, 229, p. 355, and Barbier, *Compt. rend.*, 117, pp. 177, 1092). Bertram and Gildemeister, in the laboratory of Schimmel & Co., have recently shown, however, that the so-called "rhodinol" is simply impure geraniol, the latter being associated in the oil with a very small amount of a substance, or possibly mixture of substances, having a honey-like odor, and which combine to produce the peculiarly fragrant odor of rose oil. (See *Journ. für prakt. Chem.*, N. F., Bd. 49, pp. 185-196; also Schimmel & Co.'s *Bericht*, April, 1894, pp. 47-49.)

The solid, crystallizable portion, or so-called *stearopten*, of Oil of Rose is odorless when pure, and consists of a mixture of several hydrocarbons, one of which melts at 35.5° to 36.5° C., and has the composition $C_{20}H_{42}$.

The test with concentrated sulphuric acid, proposed by Panajotow (*Ber. d. deutsch. chem. Ges.*, 24, p. 2700), and adopted by the U. S. Pharmacopœia, for the detection of the Indian or so-called Turkish Oil of Geranium (from *Andropogon Schoenanthus* Linné) and the Oil of Rose Geranium (from various species of *Pelargonium*), appears to afford quite reliable indications if the amount of these adulterants be considerable, and especially if there be added to the mixture of 5 drops of oil and 5 drops of concentrated sulphuric acid about 5 Cc. of alcohol, instead of 2 Cc. as officially directed. Like all similar empirical tests, it possesses, however, the element of uncertainty, and the general physical characters, such as odor, congealing point, specific gravity, optical rotation, etc., still continue to afford useful criterions respecting the character and purity of this oil.

The German Oil of Rose, distilled by Messrs. Schimmel & Co. in a factory erected for this special purpose and located directly in their rose fields at Miltitz, near Leipsic, is an exceptionally fine article, being of absolute purity and unsurpassable fragrance.

Oil of Rose is used exclusively for its delicious perfume, or for imparting flavor to other substances.

Oil of Rosemary.

Oleum Rosmarini.

(German: Rosmarin-Oel.)

Distilled from the leaves of *Rosmarinus officinalis* Linné (Nat. Ord. *Labiatae*).

"A colorless or pale yellow, limpid liquid, having the characteristic, pungent odor of rosemary, and a warm, somewhat camphoraceous taste. Specific gravity 0.895 to 0.915" (0.900 to 0.910, Schimmel & Co.). It deviates polarized light to the right. One part of the oil should form a clear solution with $\frac{1}{2}$ to $1\frac{1}{2}$ times its volume of alcohol of 90 per cent. by volume, at a temperature of about 20° C.

By the above tests of specific gravity, optical rotation, and solubility, admixtures of either French or American oil of turpentine can readily be detected. The oil contains pinene, cineol, borneol, and camphor.

Oil of Rosemary is largely used in perfumery. Medicinally, it is occasionally used internally as a stimulant and carminative, and externally in liniments and ointments.

Oil of Sandal Wood, see Oil of Santal.

Oil of Santal.

Oleum Santali.

[Oil of Sandal Wood.]

(German: Sandelholz-Oel.)

Distilled from the wood of *Santalum album* Linné (Nat. Ord. *Santalaceae*).

“A pale yellowish or yellow, somewhat thickish liquid, having a peculiar, strongly aromatic odor, and a pungent, spicy taste. Specific gravity 0.970 to 0.978” (0.975 to 0.980, Schimmel & Co.). Optical rotation -17° to -20° . “1 Cc. of the oil should form a clear solution with 10 Cc. of alcohol of 70 per cent. by volume, and at a temperature of about 20° C. (test for *cedarwood oil*, *fatty oils*, etc.).”

The East Indian or official Oil of Santal contains, according to Chapoteaut (*Bull. Soc. Chim.* (N. S.), 37, 1882, p. 303), a body called *santalal*, $C_{15}H_{24}O$, boiling at 300° C., together with a smaller amount of an alcoholic body termed *santalol*, $C_{15}H_{26}O$, which boils at 310° C., and is converted by phosphorus pentoxide into *santalene*, $C_{15}H_{24}$, boiling at 260° C.

Oil of Santal is used in perfumery, and medicinally as a substitute for copaiba in diseases of the mucous membranes.

The above described oil may readily be distinguished from the following non-official varieties of oil of santal:

Oil of Santal, African.

Distilled from a wood of unknown botanical origin, from Madagascar. The oil has a ruby-red color, and the consistence of East Indian sandal wood oil. Specific gravity 0.969.

Oil of Santal, South Australian.

Distilled from the wood of *Santalum Preissianum* Miquel.

This oil has a cherry-red color, and is very thick or solid at ordinary temperatures. Specific gravity 1.022. It contains a crystallizable alcohol, $C_{15}H_{24}O$, which fuses at $101-103^{\circ}$ C. (See Schimmel & Co.'s *Bericht*, April, 1894, p. 50.)

Oil of Santal, West Australian (Swan River).

Distilled from the wood of *Santalum cygnorum* Miquel.

The oil has a sharp, resinous-empyreumatic odor. Specific gravity 0.953. Optical rotation $+5^{\circ} 20'$.

Oil of Santal, West Indian.

Distilled from a wood of unknown botanical origin. Specific gravity 0.963 to 0.967. Optical rotation about $+26^{\circ}$.

Oil of Sassafras.**Oleum Sassafras.**

(German: Sassafras-Oel.)

Distilled from the bark of the root of *Sassafras variifolium* (Salisbury) O. Kuntze (Nat. Ord. *Laurineæ*).

"A yellowish or reddish-yellow liquid, having the characteristic odor of sassafras, without the odor of camphor, and a warm, aromatic taste. Specific gravity 1.070 to 1.090."

An oil distilled in our Garfield factory from sassafras bark has a specific gravity of 1.075, and an optical rotation of $+3^{\circ} 16'$.

The oil consists chiefly of safrol (see the latter, under Chemical Preparations, Part III), with a very small amount of eugenol, and a dextrogyrate hydrocarbon termed *safrene* $C_{10}H_{16}$, which is probably identical with pinene.

The so-called "Artificial Oil of Sassafras," which has been brought into American commerce, is not in any sense a synthetic product, as its misleading name would imply, but is evidently obtained by the fractionation of camphor oil. As the essential and predominating constituent of Oil of Sassafras is safrol, the advantages of the latter in a pure form are sufficiently apparent.

Oil of Sassafras is used chiefly for perfuming ordinary soaps, and for imparting flavor to beverages, etc.

Oil of Savine.**Oleum Sabinæ.**

(German: Sadebaum-Oel.)

Distilled from the tops of *Juniperus Sabina* Linné (Nat. Ord. *Conifere*).

"A colorless or yellowish liquid, becoming darker and thicker by age and exposure to the air. It has a peculiar, terebinthinate odor, and a pungent, bitterish, and camphoraceous taste. Specific gravity 0.910 to 0.940" (0.905 to 0.930, Schimmel & Co.). Optical rotation $+40^{\circ}$ to $+50^{\circ}$. It contains pinene, and cadinene $C_{15}H_{24}$.

Oil of Savine is used medicinally as a stimulant, emmenagogue, and rubefacient.

brilliance of fluorescence in individual cells were compared. Of the 25 positive smears from each

Oil of Spearmint.

(German: Speerminz-Oel.)

Distilled from the fresh herb of *Mentha viridis* Linné (Nat. Ord. *Labiatae*).

“A colorless, yellowish, or greenish-yellow liquid, becoming darker and thicker by age and exposure to the air, having the characteristic, strong odor of spearmint, and a warm, aromatic taste. Specific gravity 0.930 to 0.940” (0.920 to 0.940, Schimmel & Co.). The oil contains lævogyrate carvol and lævogyrate limonene, with possibly some lævogyrate pinene. (Compare *Oil of Caraway*.)

Oil of Spearmint is used medicinally as an aromatic stimulant and carminative, and is also employed for perfuming soaps.

Oil of Sweet Birch, see Oil of Betula.**Oil of Tar.**

(German: Theer-Oel.)

Distilled from Tar, an empyreumatic oleoresin obtained by the destructive distillation of the wood of *Pinus palustris* Miller, and of other species of *Pinus* (Nat. Ord. *Coniferae*).

“An almost colorless liquid when freshly distilled, but soon acquiring a dark reddish-brown color, and having a strong, tarry odor and taste. Specific gravity about 0.970.”

This oil is a complex mixture of hydrocarbons, acetic and other acids, and undetermined empyreumatic products present in tar.

It has the medicinal properties of tar, and is used chiefly in diseases of the skin.

Oil of Thyme.

(German: Thymian-Oel.)

Distilled from the leaves and flowering tops of *Thymus vulgaris* Linné (Nat. Ord. *Labiatae*).

“A yellowish or yellowish-red liquid, having a strong odor of thyme, and an aromatic, pungent, afterwards cooling taste. Specific gravity 0.900 to 0.930.”

Messrs. Schimmel & Co. have found Oil of Thyme of their own distillation to vary in specific gravity, according to its source, as follows:

From fresh herb, German.....	0.925-0.935.
“ dried “ “	0.909-0.928.
“ fresh “ French.....	0.934.
(cultivated in Saxony)	
“ dried herb, French.....	0.909-0.918.
“ herb, Spanish	0.925-0.950.

Oleum Menthae Viridis.**Oleum Picis Liquidæ.****Oleum Thymi.**

The most important constituent of Oil of Thyme is thymol (see the latter, under Chemical Preparations, Part III). In some oils, however, there is found, instead of thymol, the isomeric carvacrol, and in others the two phenols occur in nearly equal amounts. Other constituents are cymol, and very small amounts of bornyl esters.

The oil should form a clear solution with half its volume of alcohol (distinction from oils which have been deprived of their phenols).

Oil of Thyme is used chiefly as an external stimulant, in liniments, etc.

The following non-official, but closely related oils, may conveniently be considered here:

Oil of Thyme, Wild (*Oleum Serpylli*).

(German: Feldthymian-Oel.)

Distilled from the dry herb of *Thymus Serpyllum* Linné (Nat. Ord. Labiate).

This oil has a very agreeable, melissa-like aroma, with a slight odor of thyme. Specific gravity 0.917. Optical rotation $-10^{\circ} 20'$. It contains thymol and carvacrol.

This oil should not be confused with an oil distilled in southern France, known as "Essence de Serpolet," which is of uncertain origin, and has an odor reminding more of pennyroyal.

Oil of *Thymus camphoratus* has a specific gravity of 0.904 and contains carvacrol.

Oil of *Thymus capitatus*, distilled in southern Spain, has a strong thyme-like odor, reminding somewhat of origanum. Specific gravity 0.901. It contains pinene, cymol, dipentene, bornyl acetate, thymol, and probably carvacrol.

Oil of Turpentine.

Oleum Terebinthinæ.

(German: Terpentin-Oel.)

Distilled from American Turpentine, a concrete oleoresin obtained from *Pinus palustris* Miller, and from other species of *Pinus* (Nat. Ord. Conifere).

"A thin, colorless liquid, having a characteristic odor and taste, both of which become stronger and less pleasant by age and exposure to the air. Specific gravity 0.855 to 0.870" (0.855 to 0.876, Schimmel & Co.). It deviates polarized light to the right (distinction from French Oil of Turpentine). "Boiling point between 155° and 170° C. It is soluble in 3 times its volume of alcohol, and in an equal volume of glacial acetic acid."

Oil of Turpentine, Rectified.

(German: Rectificirtes Terpentin-Oel.)

Oleum Terebinthinæ Rectificatum.

This oil, purified from resinous matter and other oxidation products according to the directions of the Pharmacopœia, is the only form in which Oil of Turpentine is suitable for internal use. "It is a perfectly colorless liquid, having a mild odor, and the general properties mentioned under Oil of Turpentine. Specific gravity 0.855 to 0.865. Boiling point about 160° C." 10 Cc. of the freshly rectified oil, when evaporated on a water bath, should leave a residue weighing not more than about 0.02 gramme. The oil consists chiefly of dextrogyrate pinene.

Oil of Wintergreen, Natural, see Oil of Gaultheria.

Oil of Wintergreen, Synthetic or Artificial.

[Methyl Salicylate.]

(German: Wintergreen-Oel, Synthetisch.)

Methyl Salicylas.

(CH₃) C₇ H₅ O₃.

"A colorless or slightly yellowish liquid, having a characteristic, strongly aromatic odor, and a sweetish, warm, and aromatic taste. Specific gravity 1.183 to 1.185 (when perfectly free from water, 1.187). Boiling point 219° to 221° C. It is optically inactive.

"If to 1 Cc. of Methyl Salicylate, contained in a capacious test tube, 10 Cc. of a 5 per cent. solution of sodium hydrate be added, and the mixture agitated, a bulky, white, crystalline precipitate will be produced; then, if the test tube, loosely corked, be allowed to stand in boiling water for about five minutes, with occasional agitation, the precipitate should dissolve, and form a clear, colorless or faintly yellowish solution, without the separation of any oily drops, either on the surface or at the bottom of the liquid (absence of *other volatile oils* or of *petroleum*).

"If the alkaline liquid thus obtained be subsequently diluted with about three times its volume of water, and a slight excess of hydrochloric acid added, a white, crystalline precipitate will be produced, which, when collected on a filter, washed with a little water, and recrystallized from hot water, should respond to the tests for identity and purity of salicylic acid (absence of *methyl benzoate*, etc.)."

Synthetic Oil of Wintergreen was first prepared on a large scale and brought into commerce by Messrs. Schimmel & Co., of Leipsic, and it is now also manufactured extensively in our Garfield factory. Being a definite chemical compound, and readily obtainable in a state of perfect purity, it has rapidly, and to a large extent, displaced the

natural oils of birch and gaultheria. The two latter oils, being prepared mostly by itinerant distillers, are also much more subject to adulteration than the synthetic product.

For a review of some of the fallacious tests which have been assumed to discriminate between the synthetic and natural oils, see *Pharm. Rundschau*, N. Y., 1892, pp. 7-9. (Compare also *Oil of Betula* and *Oil of Gaultheria*.)

Synthetic Oil of Wintergreen is used chiefly as a flavoring agent.

Oil of Wormseed, American, see **Oil of Chenopodium.**

PART II.

NON-OFFICIAL ESSENTIAL OILS.

The Oils included in the following List are not recognized by the United States Pharmacopœia, Seventh Decennial Revision, 1890. Many of them, however, are of Commercial Importance, while others must be regarded at present as possessing chiefly Scientific Interest.

Oil of *Achillea coronopifolia*.

Distilled in Spain from the flowering herb.

The oil is limpid, has a deep blue color, and a strong, agreeable odor, reminding of oil of tansy. Specific gravity 0.924.

Oil of *Achillea Millefolium*, see Oil of Milfoil.

Oil of *Achillea moschata*, see Oil of Iva.

Oil of Amber, Rectified.

(German: Rectificirtes Bernstein-Oel.)

An empyreumatic oil obtained from Amber, the latter being a fossil resin from *Pinites succinifer* Goepfert, and other extinct coniferous trees.

This oil was recognized by the U. S. Pharmacopœia, 1870, under the title *Oleum Succini Rectificatum*, and was described as "a colorless or pale yellow, thin liquid, becoming darker and thicker by age and exposure to the air, having an empyreumatic, balsamic odor, and a specific gravity of about 0.920."

We have found the specific gravity of the crude oil to be about 0.975, and that of the rectified oil 0.915. A normal rectified oil is not colorless, but possesses a brown color, becoming darker by age.

The oil consists chiefly of a mixture of hydrocarbons, with some phenols. It is rarely employed medicinally, and chiefly externally in the form of liniments.

Oil of Ambrette Seed.

(German: Mosehuskörner-Oel.)

Distilled from the seed of *Abelmoschus moschatus* Moench (Nat. Ord. *Malvacee*).

This oil is solid at a temperature below 10° C. It has a strong and persistent odor, reminding of musk and civet. Specific gravity 0.900 to 0.905 at 25° C. It contains a free fatty acid, possibly palmitic, which separates partially at ordinary temperatures. The oil has not been further examined chemically. It is of value in perfumery.

A fictitious article occurring in commerce has been found to consist chiefly of copaiba oil.

Oil of Ammoniac.

(German: Ammoniakgummi-Oel.)

Distilled from Ammoniac, the latter being a gum-resin obtained from *Dorema Ammoniacum* Don (Nat. Ord. *Umbellifere*).

The oil has a dark yellow color, a strong odor of the drug, and reminding also of oil of angelica. Specific gravity 0.891. It boils between 250° and 290° C. It appears not to have been further examined chemically.

Oil of Angelica Fruit.

(German: Angelicafrüchte-Oel.)

Distilled from the fruit, commonly called seed, of *Archangelica officinalis* Hoffmann (Nat. Ord. *Umbellifere*).

The oil has a pale yellow color, but becomes darker and thicker by age. Its odor resembles that of the oil from the root, but is much finer. Specific gravity 0.850 to 0.900. Optical rotation +11° 13' to +11° 45'. It contains phellandrene, valerianic acid (methyl ethyl-acetic acid), and oxymyristic acid $C_{11}H_{22}O_3$.

Oil of Angelica Root.

(German: Angelicawurzel-Oel.)

Distilled from the root of *Archangelica officinalis* Hoffmann (Nat. Ord. *Umbellifere*).

A limpid liquid, colorless when freshly distilled, but becoming yellow on exposure to light, and having a strongly aromatic odor and taste. Specific gravity 0.855 to 0.905. Optical rotation +26° 45' to +30° 7'. It contains various terpenes, among which phellandrene has been identified.

The oil is used in the preparation of liquors.

Japanese Angelica Root, from either *Angelica refracta* Fr. Schmidt (Jap.: "Senkiyu"), or *Angelica anomala* Lall (Jap.: "Biyakushi"),

affords an oil which differs from the German in odor and composition. Its specific gravity is 0.910 at 20° C. At 10° C. it separates crystals, and at 0° C. forms a butter-like mass. The crystals have the character of a fatty acid, and melt at 62° to 63° C. The oil distills between 170° and 300° C.

Oil of Angostura Bark.

(German: Angosturarinden-Oel.)

Distilled from the bark of *Galipea Cusparia* St. Hilaire (Nat. Ord. *Rutaceæ*).

The oil has a yellow color, becoming darker on exposure to the air, and an aromatic odor and taste. Specific gravity 0.956. It is very slightly lævogyrate. It begins to boil at 153° C., and distills mostly between 200° and 220° C.

Oil of Anise Bark.

(German: Anisrinden-Oel.)

Distilled from a bark of uncertain botanical origin, from Madagascar.

The oil has a light yellow color, an odor reminding of safrol and estragon, and a spicy, but only slightly sweetish taste. Specific gravity 0.969. Besides a small amount of anethol, it consists chiefly of a liquid isomer of the latter, para-methoxy-allyl-benzol or methylchavicol, $\text{CH}_3 \text{O}-\text{C}_6\text{H}_4-\text{CH}_2-\text{CH}=\text{CH}_2$.

Oil of Anise, Star (Chinese).

(German: Sternanis-Oel.)

Distilled from the fruit of *Illicium verum* Hooker fil (Nat. Ord. *Magnoliaceæ*).

A colorless or yellowish liquid, having an anise-like odor and taste. Specific gravity 0.980 to 0.990 at 17° C. Congealing point 12° to 18° C. This oil, like the official oils of anise and fennel, often shows an inclination to remain liquid at a temperature below its true congealing point. To determine the latter, a small portion of the oil, contained in a test tube, should be cooled to about 12° to 14° C. by means of cold water. A few crystals, previously obtained by solidifying a little of the oil in a freezing mixture, are then brought into the liquid oil by means of a glass rod, when the entire liquid should solidify to a mass of crystals.

The oil consists chiefly of anethol, together with pinene, phellandrene, safrol, and the ethyl ether of hydroquinone.

The uses of this oil are similar to those of the official Oil of Anise.

Oil of Japanese Star Anise, from the fruit of *Illicium religiosum* Loureiro, has a specific gravity of 0.984 to 0.994, and contains a terpene, anethol, and safrol.

Oil of Anona, see **Oil of Ylang Ylang.**

Oil of Apple, Artificial, see **Amyl Valerianate,** under
Chemical Preparations, Part III.

Oil of Arbor Vitæ, see **Oil of Thuja.**

Oil of Arnica Flowers.

(*German*: Arnieablüthen-Oel.)

Distilled from the flowers of *Arnica montana* Linné (Nat. Ord. *Compositæ*).

The oil is usually of a yellowish color, becoming brown with age, and has a strongly aromatic odor and taste. Specific gravity 0.900 at 25° C. The physical characters of the oil are subject to considerable variation, depending upon the amount of stearopten or paraffin-like bodies present. Thus, while the oil is sometimes liquid at ordinary temperatures, solidifying only in winter, the product of other distillations forms at 15° to 20° C. a butter-like mass (see Schimmel & Co.'s *Bericht*, April, 1894, p. 9).

The oil appears not yet to have been chemically examined.

Oil of Arnica Root.

(*German*: Arnicawurzel-Oel.)

Distilled from the root of *Arnica montana* Linné (Nat. Ord. *Compositæ*).

The oil has a yellow color, becoming darker with age, a strong odor, and sharp, aromatic taste. Specific gravity 0.990 to 1.0. It contains about 80 per cent. of the dimethyl ether of thymohydroquinone, $C_{10}H_{12}(OCH_3)_2$, and 20 per cent. of phlorol iso-butyric ester, $C_3H_7-COOC_8H_9$, with a very little phlorol-methyl ether, $C_8H_9-OCH_3$.

The oil is occasionally used medicinally.

Oil of Artemisia Absinthium, see **Oil of Wormwood.**

Oil of Artemisia Borellieri.

Distilled in southern Spain from the flowering herb of *Artemisia Borellieri* Boiss. (Nat. Ord. *Compositæ*.)

The oil has an agreeable and strongly aromatic odor, reminding of tansy. Specific gravity 0.923. It boils between 180° and 210° C.

Oil of Artemisia Dracunculus, see **Oil of Estragon.**

Oil of *Artemisia glacialis*.

(German: Alpenbeifuss-Oel.)

Distilled from the herb of *Artemisia glacialis* Luc., the so-called *Genepi des Alpes* (Nat. Ord. *Compositæ*).

The oil has a strongly aromatic odor. Specific gravity 0.964 at 20° C. It solidifies at 0° to a butter-like mass, which is due to the presence of a fatty acid having a melting point of 61° C. The oil boils between 195° and 310° C.

Oil of *Artemisia maritima*, see Oil of Wormseed, Levant.

Oil of *Artemisia vulgaris*.

(German: Beifuss-Oel.)

This oil has been distilled both from the herb and the root of *Artemisia vulgaris* Linné, or common Mugwort (Nat. Ord. *Compositæ*).

The oil from the herb has a specific gravity of 0.920, but has not been further examined.

Oil of *Asafetida*.

(German: Asafœtida-Oel.)

Distilled from *Asafetida*, a gum resin obtained from the root of *Ferula foetida* (Bunge) Regel (Nat. Ord. *Umbellifere*).

The oil has a light yellow color, and the penetrating, disagreeable odor of the drug. The specific gravity has been observed to be in one specimen 0.9789 at 12° C., and in another 0.9843 at 22° C. (Semmler), or 0.985 at 15° C. (Schimmel & Co.), and 0.9515 at 25° C. (Flückiger). Optical rotation $-9^{\circ} 15'$ (Semmler), or $+13^{\circ}$ to $+19^{\circ}$ (Flückiger). The oil is stated to contain two terpenes $C_{10}H_{16}$, a body of the composition $C_{10}H_{16}O$, which yields a sesquiterpene $C_{15}H_{24}$, the sulphur compounds $C_7H_{11}S_2$ and $C_{11}H_{20}S_2$, and a blue colored oil in the higher boiling portions. (Semmler, *Ber. d. deutsch. chem. Ges.*, 1890, p. 3530, and 1891, p. 78.)

Oil of *Asarum Canadense*.

(German: Canadische-Schlangenwurzel-Oel.)

Distilled from the rhizome and roots of *Asarum Canadense* Linné, "Canada Snake Root" (Nat. Ord. *Aristolochiaceæ*).

The oil has a yellowish or yellowish-brown color, and a strong, agreeably aromatic odor and taste. Specific gravity 0.930 to 0.960. It contains a small amount of a terpene (about 5 per cent.); an alcohol $C_{10}H_{17}-OH$, boiling point 197° to 199° C., termed *asarol*, probably identical with linalool (about 35 per cent.); an alcohol

$C_{10}H_{17}-OH$, boiling point 223° to 226° C., having a geranium-like odor (about 15 per cent.); the methyl ether of eugenol $C_6H_3(C_3H_5)(OCH_3)_2$ (about 35 per cent.); acetic and valerianic acids, as esters of the above mentioned alcohols; and a high boiling fraction of a deep blue color (about 10 per cent.), but no *asarone*. (*Proc. Amer. Pharm. Assoc.*, 1880, pp. 464-485; *Pharm. Rundschau*, 1888, p. 101; *Ber. d. deutsch. chem. Ges.*, 21, p. 1064.) Compare also *Oil of Asarum Europæum*.

The oil forms a clear solution with twice its volume of 70 per cent. alcohol. It is of value in perfumery.

Oil of Asarum Europæum.

(German: Asarum-Oel or Haselwurz-Oel.)

Distilled from the rhizome and roots of *Asarum Europæum* Linné, "Asarabacca" (Nat. Ord. *Aristolochiaceæ*).

A somewhat thick, brownish liquid, having a sweetish-aromatic odor. Specific gravity 1.046 to 1.068. It contains pinene; the methyl ether of eugenol $C_6H_3(C_3H_5)(OCH_3)_2$; asarone $C_6H_2(C_3H_5)(OCH_3)_3$; and a high boiling fraction of a bluish color, but no asarol (*Archiv der Pharm.*, 1888, pp. 89-123, and *Ber. d. deutsch. chem. Ges.*, 21, pp. 1057-1063). Compare also *Oil of Asarum Canadense*.

Oil of Balsam Peru.

(German: Peru Balsam-Oel.)

Distilled from the balsam of *Toluiifera Pereiræ* (Royle) Baillon (Nat. Ord. *Leguminosæ*).

A light colored liquid, having an agreeably aromatic odor, reminding of Balsam of Peru, of which it is the chief constituent. It consists for the most part of "cinnameïn," the benzyl esters of cinnamic and benzoic acids. According to Trog (*Archiv der Pharm.*, 1894, pp. 70-98), the liquid portion of Balsam of Peru consists chiefly of benzyl benzoate, $C_7H_7(C_6H_5O_2)$, with only a very small amount of benzyl cinnamate, $C_7H_7(C_8H_7O_2)$.

The oil is used in perfumery.

Oil of Balsam Tolu.

(German: Tolu Balsam-Oel.)

Distilled from the balsam of *Toluiifera Balsamum* Linné (Nat. Ord. *Leguminosæ*).

The oil has a very agreeable, hyacinth-like odor. Specific gravity 0.935 to 0.975. It contains a terpene $C_{10}H_{16}$, and esters of cinnamic and benzoic acid.

The oil is of value in perfumery.

Oil of Basilicum or Basil.

(German: Basilicum-Oel.)

Distilled from the herb of *Ocimum Basilicum* Linné (Nat. Ord. *Labiatae*).

The oil has an aromatic odor. That from fresh German herb has a specific gravity of 0.918 to 0.928, while that from Réunion is 0.946 to 0.967, and has an optical rotation of $+16'$. The oil has not yet been chemically examined.

Oil of Beech Tar.

(German: Buchentheer-Oel.)

Obtained by the fractional distillation of Beech Tar, the latter being a product of the dry distillation of the wood of *Fagus silvatica* Linné (Nat. Ord. *Cupuliferae*).

The *light oil*, which is usually employed, has a specific gravity of 0.980, and distills between 80° and 250° C. The main portion distills between 150° and 250° C., and consists of from one-third to one-half of phenols and phenol-ethers.

The *heavy oil* has a specific gravity of 1.053. It distills between 220° and 300° C., and contains about 66 per cent. of phenols.

Oil of Beech Tar has been used in lung diseases.

Oil of Betle Leaves.

(German: Betel-Oel.)

Distilled from the leaves of *Piper Betle* Linné (Nat. Ord. *Piperaceae*).

The oil has a light brown color, an agreeable tea-like odor, and a burning taste. The oil of dried leaves from Siam has a specific gravity of 1.034, that of fresh leaves from Manila 1.044, and that of fresh leaves from Java 0.958, and an optical rotation of $+2^{\circ} 53'$. The oil contains betle-phenol or para-eugenol $C_6H_3(C_3H_5)(OH)(OCH_3)$, cadinene $C_{15}H_{24}$, and sometimes para-allyl-phenol or chavicol $C_6H_4(OH)(C_3H_5)$. (See Schimmel & Co.'s *Bericht*, April, 1890, p. 6, October, 1891, p. 5, and *Journ. für prakt. Chemie*, N. F., 1889, p. 349.)

Oil of Birch Tar (*Oleum Rusci*).

(German: Rectificirtes Birkentheer-Oel.)

Distilled from Birch Tar (German: Juchten-Oel), the latter being a product of the dry distillation of the wood of *Betula alba* Linné (Nat. Ord. *Cupuliferae*).

A yellowish-brown liquid, having a characteristic odor, like that of Russia leather. Specific gravity about 0.956. It contains about 40

per cent. of phenols, which boil between 180° and 250° C., and consist chiefly of guaiacol and creosol, with small amounts of cresol and xylénol. The portion insoluble in alkalies boils between 170° and 288° C. (See Schimmel & Co.'s *Bericht*, April, 1891, p. 6, and *Archiv der Pharm.*, 1890, p. 713.)

Oil of Boldo Leaves.

(German: Boldoblätter-Oel.)

Distilled from the leaves of *Boldoa fragrans* Gay (Nat. Ord. *Monimiaceæ*).

The oil has a reddish-yellow color, the pepper-like, narcotic odor of the leaves, and a mild, herby taste. Specific gravity 0.918 to 0.945. It boils between 175° and 250° C., and contains terpenes and oxygenated bodies.

The oil has been used medicinally in affections of the liver, dyspepsia, rheumatism, etc.

Oil of Bugle Weed.

(German: Lycopus-Oel.)

Distilled from the dry herb of *Lycopus Virginicus* Linné (Nat. Ord. *Labiataæ*).

The oil has a characteristic odor, which is difficult to define. Specific gravity 0.924. It has not yet been chemically examined. The herb is said to possess mild narcotic properties.

Oil of Buchu.

(German: Buccublätter-Oel.)

Distilled from the leaves of *Barosma serratifolia* Willdenow and *Barosma betulina* Bartling (Nat. Ord. *Rutaceæ*).

The oil has a strong mint-like odor. That from *B. serratifolia* has a specific gravity of 0.944, and contains but little of the crystallizable diosphenol $C_{10}H_{16}O_2$. The oil from *B. betulina* contains a large amount of diosphenol, and, after the separation of the latter at ordinary temperatures, has a specific gravity of 0.969. There is also present in the oil a body of the composition $C_{10}H_{18}O$, having a peppermint-like odor.

Oil of Calamus

(German: Calmus-Oel.)

Distilled from the rhizome of *Acorus Calamus* Linné, "Sweet Flag" (Nat. Ord. *Aroideæ*).

A clear, somewhat thick, brownish-yellow liquid, having a strongly aromatic odor, and an aromatic, bitter taste. The oil from fresh German calamus has a specific gravity of 0.960 to 0.970, and an

optical rotation of $+20'$ to $+31'$, while that from the dry drug has a specific gravity of 0.960 to 0.980, and an optical rotation of $+15^\circ$ to $+21'$. The oil appears to contain pinene and a sesquiterpene, a body of the composition $C_{10}H_{16}O$, a high boiling fraction of a bluish color, and a very small amount of a phenol.

Oil of Calamus is used to a small extent medicinally as a tonic and carminative, but chiefly in the preparation of liquors.

Oil of Japanese Calamus is characterized by a higher specific gravity, 0.985 to 1.00, and by its much greater solubility in dilute alcohol.

Oil of Camphor.

(German: Camphor-Oel.)

The crude *Japanese Camphor Oil* is obtained as a by-product in the preparation of common camphor, by the distillation of the wood of *Cinnamomum Camphora* (Linné) Nees et Ebermaier (Nat. Ord. Lauraceæ).

It is an exceedingly complex substance, and contains, according to the researches conducted in the laboratories of Messrs. Schimmel & Co., of Leipsic, the following bodies:

Pinene,	$C_{10}H_{16}$	Boiling point	158–162° C.
Phellandrene,	$C_{10}H_{16}$	“ “	about 170° C.
Cineol,	$C_{10}H_{18}O$	“ “	176° C.
Dipentene,	$C_{10}H_{16}$	“ “	180° C.
Camphor,	$C_{10}H_{16}O$	“ “	204° C.
Terpineol (?),	$C_{10}H_{17}-OH$	“ “	215–218° C.
Safrol,	$C_{10}H_{10}O_2$	“ “	232° C.
Eugenol,	$C_{10}H_{12}O_2$	“ “	248° C.
Sesquiterpene (Cadinene),	$C_{15}H_{24}$	“ “	274° C.

By fractional distillation the original crude oil affords the commercial *Light Camphor Oil*, specific gravity about 0.920, and the so-called *Heavy Camphor Oil*, specific gravity about 0.970.

Messrs. Schimmel & Co., of Leipsic, have also distilled in their own factory, from crude material obtained from Japan, the following:

Oil of Camphor Leaves and Oil of Camphor Root.

Both of these oils contained a large amount of camphor, and the liquid portion separated therefrom has the properties of the above mentioned, ordinary camphor oil of commerce.

Oil of Canada Snake Root,

see **Oil of Asarum Canadense.**

Oil of Cananga, Java.

(German: Cananga-Oel, Java.)

Distilled from the flowers of *Cananga odorata* Hooker fil. et Thomson (Nat. Ord. *Anonaceæ*).

The Cananga flowers are known by the natives of the South Sea Islands as "Mosoi." The oil has a yellowish color, and an exceedingly agreeable odor, which renders it valuable as a perfume. The odor, however, is not nearly so delicate as that of the so-called "Ylang-Ylang Oil," which is distilled in Manila from the same plant (see *Oil of Ylang-Ylang*; also Schimmel & Co.'s *Bericht*, October, 1887, p. 7, and "Odorographia" by Sawer, p. 117).

Oil of Cananga has a specific gravity of 0.910 to 0.920. It contains an ester of benzoic acid.

Oil of Canella.

(German: Canella-Oel or Weisszimmt-Oel.)

Distilled from the bark of *Canella alba* Murray (Nat. Ord. *Canelaceæ*).

The oil has a spicy odor and taste. Specific gravity 0.922. It contains cineol and eugenol.

Oil of Cardamom.

(German: Cardamomen-Oel.)

Distilled from the seed of *Elattaria repens* (Sonnérat) Baillon (Nat. Ord. *Scitamineæ*).

The oil has a pale yellow color, and a strongly aromatic, somewhat camphoraceous odor and taste. Specific gravity 0.895 to 0.905. Optical rotation about $+13^{\circ}$. It contains terpinene, possibly dipentene, a body of the composition $C_{10}H_{18}O$ (terpineol?), and acetic and formic acids. The oil affords a clear solution with one or more parts of 80 per cent. alcohol.

Oil of Cardamom is used chiefly in the preparation of liquors.

Oil of Carlina.

(German: Eberwurz-Oel.)

Distilled from the root of *Carlina acaulis* Linné (Nat. Ord. *Compositæ*).

The oil has a dark reddish-brown color, and a narcotic odor. Specific gravity 1.033 to 1.036. Its constituents have not yet been determined.

Oil of Carrot, Wild.

(German: Daucus-Oel or Möhrensamen-Oel.)

Distilled from the fruit of *Daucus Carota* Linné (Nat. Ord. *Umbelliferae*).

It has a yellowish color, an agreeable carrot-like odor, and a sharp taste. Specific gravity 0.87 to 0.93. Optical rotation -13° . It contains pinene, and a body of the composition $C_{10}H_{18}O$, which is possibly cineol.

Oil of Casca preciosa.

(German: Casca preciosa-Oel.)

Distilled from the bark of *Mespilodaphne pretiosa* N. et M. (Nat. Ord. *Lauraceae*).

It has a strong cinnamon-like odor and a burning, aromatic taste. Specific gravity 1.118. It has not yet been thoroughly examined, but appears not to contain cinnamic aldehyde.

Oil of Cascarilla.

(German: Cascarill-Oel.)

Distilled from the bark of *Croton Eluteria* Bennett (Nat. Ord. *Euphorbiaceae*).

It has a greenish or dark yellow color, and a purely aromatic odor and taste. Specific gravity 0.890 to 0.930. It has not yet been sufficiently examined chemically (see Liebig's *Annalen*, Bd. 35, p. 307).

Oil of Catnip.

(German: Katzenminz-Oel.)

Distilled from the herb of *Nepeta cataria* Linné (Nat. Ord. *Labiatae*).

This oil has a mint- and camphor-like, but not particularly agreeable odor. Specific gravity 1.041. It has not yet been chemically examined.

Oil of Cedar Leaves, American.

(German: Cedernblätter-Oel.)

Distilled from the leaves of the Red Cedar, *Juniperus Virginiana* Linné (Nat. Ord. *Coniferae*).

A colorless liquid, having a savine-like odor. Specific gravity about 0.884. Optical rotation $-8^\circ 15'$.

The above characters are based upon the examination of a commercial oil, but an oil distilled in our Garfield factory, from leaves collected in late autumn, differs considerably, especially with regard to its rotation. It is a pale greenish-yellow liquid, having a persistent, but not disagreeable odor. Specific gravity 0.886. Optical rotation $+59^\circ 5'$. It has not yet been chemically examined. The medicinal properties of the oil are probably similar to those of the official Oil of Savine.

Oil of Cedar Wood, Florida.

(German: Cedernholz-Oel.)

Distilled from the wood of *Juniperus Virginiana* Linné (Nat. Ord. *Coniferae*).

A pale yellow or greenish-yellow, thickish liquid, having a characteristic, agreeable odor. Specific gravity 0.940 to 0.960. Optical rotation -20° to -40° . Refractive index n_D 1.50567 at 17° C. It contains cadinene $C_{15}H_{24}$, and cedar camphor $C_{15}H_{26}O$.

The oil is used largely for perfuming ordinary soap.

Oil of Cedar Wood, for microscopical purposes, has the refractive index n_D 1.51682 at 17° C.

Oil of Cedar Wood, Lebanon.

(German: Cedernholz-Oel, Libanon.)

Distilled from the wood of *Cedrus Libani* Barr (Nat. Ord. *Coniferae*).

The oil has a brownish-yellow color, and a very agreeable, cedar-like odor. Specific gravity 0.985. Optical rotation $-10^{\circ} 48'$.

Messrs. Schimmel & Co. have also distilled the following oils from woods of uncertain botanical origin. (See *Bericht*, April, 1892, p. 41):

Oil of Cedar Wood, Corinto.

The oil has a yellow color. Specific gravity 0.906. Optical rotation $-17^{\circ} 23'$.

Oil of Cedar Wood, Cuba.

The oil has a slightly yellowish color. Specific gravity 0.923. Optical rotation $+18^{\circ} 6'$. It contains cadinene $C_{15}H_{24}$.

Oil of Cedar Wood, La Plata.

The oil has a light blue color. Specific gravity 0.928. Optically inactive.

Oil of Cedar Wood, Punta Arenas.

The oil has a light blue color. Specific gravity 0.915. Optical rotation $-5^{\circ} 53'$. It consists chiefly of cadinene $C_{15}H_{24}$.

Oil of Celery.

(German: Sellerie-Oel.)

Distilled from the fruit of *Apium graveolens* Linné (Nat. Ord. *Umbelliferae*).

The oil has a yellowish color, and the characteristic odor and taste of celery. Specific gravity 0.880 to 0.890. Optical rotation $+67^{\circ} 4'$. It contains dextrogyrate limonene, but no pinene. An adulteration with oil of turpentine may thus readily be detected.

Oil of Chamomile, German.

(German: Chämillen-Oel, Deutsch.)

Distilled from the flower heads of *Matricaria Chamomilla* Linné (Nat. Ord. *Compositæ*).

The oil has at first a bluish color, which, by exposure to light, changes to green and brown. It has the characteristic odor of chamomile, and a bitterish, aromatic taste. Specific gravity 0.930 to 0.945. At a low temperature the oil solidifies to a butter-like mass, which is due to the presence of a paraffin-like body, having in a pure state a melting point of 53° — 54° C. The oil appears to contain esters, but it has not yet been sufficiently examined (see *Ber. d. deutsch. chem. Ges.*, 4, p. 36; also Schimmel & Co.'s *Bericht*, April, 1894, p. 13).

Oil of Chamomile, Roman.

(German: Chamillen-Oel, Römisch.)

Distilled from the flower heads of *Anthemis nobilis* Linné (Nat. Ord. *Compositæ*).

The oil has at first a bluish color, which changes to greenish-yellow or brownish yellow. It has a strong, agreeable odor, and burning taste. Specific gravity 0.905 to 0.915. It contains the isobutyl esters of isobutyric and angelic acids, the amyl esters of tiglic and angelic acids, the hexyl esters of tiglic and angelic acids, and anthemol $C_{10}H_{16}O$. (See Liebig's *Annalen*, Bd. 195, 1879, p. 78.)

Oil of Champaca.

(German: Champaca-Oel.)

Distilled in Java from the flowers of *Michelia Champaca* Linné

A thin, pale yellow liquid, having an odor reminding somewhat of oil of orris. Specific gravity 0.914. Optical rotation $-13^{\circ} 14'$.

An oil received some years ago from Manila, which had been distilled from freshly gathered Champaca flowers, was of quite a different character from the above described Java oil. It had a reddish-yellow color, and an incomparable fragrance, somewhat reminding of cassie flowers. Even at ordinary temperatures an abundance of crystals separated from this oil. (See Schimmel & Co.'s *Bericht*, April, 1894, p. 58.)

The flowers of *Michelia longifolia*, which have likewise been distilled in Java, afford a nearly colorless essential oil. This is very volatile, and has an odor strongly reminding of basilicum. Its

specific gravity is 0.883. Optical rotation $-12^{\circ} 50'$. (*Bericht*, April, 1894, p. 59.)

Oil of Cheken Leaves.

(German: Chekenblätter-Oel.)

Distilled from the leaves of *Myrtus Cheken* (Nat. Ord. *Myrtaceæ*).

The oil has a yellowish or greenish color, and an agreeable, aromatic odor. Specific gravity 0.879. Optically dextrogyrate. It consists chiefly of pinene, with some cineol, and an undetermined higher boiling (220° to 280° C.) portion.

Oil of Cherry Laurel.

(German: Kirschlorbeer-Oel.)

Distilled from the leaves of *Prunus Lauro-cerasus* Linné (Nat. Ord. *Rosaceæ*).

Specific gravity 1.055 to 1.065. It contains benzaldehyde, hydrocyanic acid (about 3 per cent.) and benzyl alcohol. It is therefore similar in composition to bitter almond oil.

It is used chiefly in the preparation of liquors.

Oil of Cistus.

(German: Cistus-Oel.)

Distilled in southern Spain from the leaves of *Cistus ladaniferus* Linné (Nat. Ord. *Cistaceæ*).

The oil has a disagreeable, narcotic odor. Specific gravity 0.925. It boils between 165° and 280° C., but has not yet been chemically examined.

Oil of Citronella.

(German: Citronell-Oel.)

Distilled in India from the grass of species of *Andropogon*, usually referred to *A. Nardus* Linné (Nat. Ord. *Gramineæ*).

A limpid, yellowish or greenish-yellow, or, when rectified, nearly colorless liquid, having a very agreeable odor. Specific gravity 0.895 to 0.910. The chemical investigations of this oil present somewhat varying results, which may no doubt be explained in part by the supposition that the oil is not of constant composition, and not always the product of a single plant species.

E. Kremers (*Proc. Amer. Pharm. Assoc.*, 1887, pp. 562-578) found the oil to contain a terpene, heptolic aldehyde $C_7H_{14}O$, fractions boiling at 217° - 222° , and 222° - 230° C. respectively, and having the composition $C_{10}H_{18}O$, which were designated as *citronellol*, and acetic and valerianic acids in the form of esters (see also Kremers, *Amer. Chem. Journ.*, XIV, pp. 203-212; Dodge, *Ibidem*, XI, p. 456, XII, p. 553; Semmler, *Ber. d. deutsch. chem. Ges.*, 24, p. 208, 26, p. 2254).

Messrs. Schimmel & Co. (*Bericht*, October, 1888, p. 16, October, 1893, p. 11, April, 1894, p. 15) have found in this oil: camphene, dipentene, geraniol $C_{10}H_{18}O$, citronellal $C_{10}H_{18}O$ (see the latter, under Chemical Preparations, Part III), and from 1 to 2 per cent. of lævogyrate borneol $C_{10}H_{18}O$.

Oil of Citronella has heretofore been largely adulterated, even in India, and especially with fatty oils and petroleum. These may be detected by the following simple and reliable test, proposed by Messrs. Schimmel & Co.: If 1 Cc. of the oil be vigorously shaken in a glass-stoppered cylinder or well corked test tube with 10 Cc. of alcohol, of 80 per cent. by volume, it should form a clear or only slightly opalescent solution, from which on standing for at least twelve hours no oil drops should separate, either on the surface or at the bottom of the liquid.

Oil of Citronella is used chiefly for its agreeable perfume, in soaps, etc.

Oil of Citronella Fruit.

(German: Citronellfrüchte-Oel.)

Distilled from the fruit of *Tetranthera citrata* Nees (Nat. Ord. *Lauraceæ*).

This oil has an agreeable, verbena-like odor, and has therefore been designated *Oil of Verbena, Java*. Specific gravity 0.894.* It contains citral and a terpene.

Oil of Clove Root.

(German: Nelkenwurz-Oel.)

Distilled from the root of *Geum urbanum* Linné (Nat. Ord. *Rosaceæ*).

The oil has an exceedingly agreeable, cinnamon-like odor, and a spicy taste. It has not yet been further examined.

Oil of Cochlearia, Synthetic.

(German: Löffelkraut-Oel, Synthetisch.)

This is identical with the chief constituent of the oil of scurvy-grass (*Cochlearia officinalis* Linné, Nat. Ord. *Crucifereæ*). It is the isosulphocyanate of secondary butyl alcohol, or secondary butyl thiocarbimide, $CSN-CH(C_2H_5)CH_3$. Its specific gravity is 0.944 at 12° C. and boiling point 159° to 160° C.

A good *Spiritus Cochleariæ* may be made by dissolving 2 grammes of the oil in 1 kilo of 70 per cent. (by volume) alcohol.

It may be noted that in commerce a mixture consisting simply of the oil of mustard and oil of rue is frequently sold as Oil of Cochlearia, but which has not the properties of the true oil.

Oil of Cognac, Artificial, see **Ether, Oenanthic,** under **Chemical Preparations, Part III.**

Oil of Costus.

(*German*: Costus-Oel.)

Distilled from the root of *Costus speciosus* (Nat. Ord. *Zingiberaceæ*).

The oil has a pale yellow color, and an odor reminding at first of elecampane, but which after some hours becomes violet-like. Specific gravity 0.982. Optical rotation $+15^{\circ} 29'$. It begins to boil at 275°C. , and at a somewhat higher temperature complete decomposition ensues. It has not yet been more thoroughly examined, but appears to have only scientific interest.

Oil of Coto Bark, Para.

(*German*: Paracotorinden-Oel.)

The botanical origin of this bark is unknown. The oil is colorless, and has an agreeable odor. That distilled by Messrs. Schimmel & Co. has a specific gravity of 1.018, and optical rotation $+5^{\circ} 40'$. It is soluble in three times its volume of 70 per cent. alcohol. The oil contains chiefly cadinene $\text{C}_{15}\text{H}_{21}$, and methyl-eugenol. (See Liebig's *Annalen*; 271, p. 300, and *Ber. d. deutsch. chem. Ges.*, 26, p. 2794.)

Oil of Cumin.

(*German*: Cumin-Oel or Römisch-kümmel Oel.)

Distilled from the fruit of *Cuminum Cyminum* Linné (Nat. Ord. *Umbelliferae*).

The oil is a colorless or yellowish, limpid liquid, having the characteristic odor of cumin, and a sharp, spicy taste. Specific gravity 0.890 to 0.930. It contains cymol $\text{C}_{10}\text{H}_{14}$, and cumin aldehyde $\text{C}_{10}\text{H}_{12}\text{O}$.

Oil of Curcuma.

(*German*: Curcuma-Oel.)

Distilled from the rhizome of *Curcuma longa* Linné (Nat. Ord. *Zingiberaceæ*).

The oil is limpid, has a lemon-yellow color, a penetrating odor, and a burning taste. Specific gravity 0.942. It contains phellandrene, and apparently a body isomeric with carvol $\text{C}_{10}\text{H}_{14}\text{O}$. It has found as yet but little practical use.

Oil of Cuscus, see **Oil of Vetiver.**

Oil of Damiana.

(German: Damiana-Oel.)

Distilled from the leaves of *Turnera microphylla* D. C. (Nat. Ord. *Turneraceæ*).

The oil is a greenish, thick, viscid liquid, having a chamomile-like odor. Specific gravity 0.986. It boils between 250° and 310° C., and contains in the higher boiling portion a blue oil. Its composition and properties have not been further determined.

Oil of Daucus, see Oil of Carrot, Wild.

Oil of Dilem Leaves.

(German: Dilem-Oel.)

The botanical origin of these leaves, obtained from Java, is unknown. The oil is quite thick, has a yellowish-green color, and an odor reminding of patchouli, but finer and fresher than the latter. Specific gravity 0.962. It boils between 250° and 300° C.

Oil of Dill.

(German: Dill-Oel.)

Distilled from the fruit of *Anethum graveolens* Linné (Nat. Ord. *Umbelliferae*).

The oil has a pale yellow color, a characteristic, penetrating odor, and at first a sweetish, afterwards sharp and burning taste. Specific gravity 0.905 to 0.915. Optical rotation +70° to +80°. It contains limonene and carvol. The oil from *East Indian Dill* has an odor quite different from German Dill Oil. Its specific gravity is 0.970. Optical rotation +41 30'. In distinction from the preceding it contains a body which is heavier than water. (See Schimmel & Co.'s *Bericht*, October, 1891, p. 12.)

Oil of Dittany.

(German: Dittany-Oel or Cunila-Oel.)

Distilled from the herb of *Cunila Mariana* Linné (Nat. Ord. *Labiatae*).

It has a reddish-yellow color, and a thyme-like odor. Specific gravity 0.915. It contains a considerable amount of a phenol, probably thymol, but has not yet been further examined.

Oil of Elecampane.

(German: Alant-Oel.)

Distilled from the root of *Inula Helenium* Linné (Nat. Ord. *Compositae*).

It is solid at ordinary temperatures, and consists chiefly of alantolactone (helenin) $C_{14}H_{20}O$, with a little sesquiterpene.

Oil of Elemi.

(German: Elemi-Oel.)

Distilled from Manila Elemi, an oleo-resin of uncertain botanical origin. The oil is nearly colorless, and has an agreeably aromatic odor and taste. Specific gravity 0.87 to 0.90. It contains phellandrene and dipentene, and higher boiling bodies which probably consist of polyterpenes and oxygenated compounds. It is used chiefly for its agreeable perfume.

Oil of Estragon.

(German: Estragon-Oel.)

Distilled from the herb of *Artemisia Dracunculus* Linné (Nat. Ord. *Compositæ*).

The oil has a peculiar odor, and a mildly aromatic taste. That distilled by Messrs. Schimmel & Co., which is of exceptionally fine quality, has a specific gravity varying from 0.906 to 0.932, and an optical rotation of $+5^{\circ} 15'$ to $+8^{\circ} 10'$, while some commercial oils vary in specific gravity from 0.920 to 0.960, with an optical rotation of $+2^{\circ} 32'$ to $+2^{\circ} 50'$.

The oil contains para-methoxy-allyl-benzol $C_6H_4(OCH_3)CH_2-CH=CH_2$, which is isomeric with anethol, and can be converted into the latter by heating with an alcoholic solution of potassium hydroxide. This body is undoubtedly also identical with the so-called "Estragol." (See *Compt. rend.*, 117, p. 1189, *Ber. d. deutsch. chem. Ges.*, 22, p. 2743, and Schimmel & Co.'s *Bericht*, April, 1894, p. 28.) Compare also *Oil of Anise Bark*.

Oil of Galangal.

(German: Galgant-Oel.)

Distilled from the rhizome of *Alpinia officinarum* Hance (Nat. Ord. *Scitamineæ*).

A reddish-yellow liquid, having an aromatic, cajuput-like odor, and a strongly camphoraceous taste. Specific gravity 0.921. Slightly lævogyrate. It contains a considerable amount of cineol, and is used to a slight extent medicinally.

Oil of Galbanum.

(German: Galbanum-Oel.)

Distilled from Galbanum, a gum-resin obtained from *Ferula galbaniflua* Boissier et Buhse (Nat. Ord. *Umbelliferae*).

The oil has a light yellow color, and the characteristic odor of the drug. Specific gravity 0.910 to 0.930. It boils between 165° and 300 °C. It contains cadinene $C_{15}H_{24}$.

Oil of Garlic.

(German: Knoblauch-Oel.)

Distilled from the bulb and herb of *Allium sativum* Linné (Nat. Ord. *Liliaceæ*).

The oil has a yellowish color, and a characteristic, exceedingly penetrating odor. Specific gravity 1.053. It contains the compound $C_6H_{12}S_2$, which is probably allyl-propyl disulphide $\left(\begin{smallmatrix} C_3H_5S \\ C_3H_7S \end{smallmatrix} \right)$, and $C_6H_{10}S_2$, which is probably diallyldisulphide $\left(\begin{smallmatrix} C_3H_5S \\ C_3H_5S \end{smallmatrix} \right)$. The higher boiling portions contain bodies of the composition $C_6H_{10}S_3$ and $C_6H_{10}S_4$ (see *Archiv der Pharm.*, 1892, p. 434, and Schimmel & Co.'s *Bericht*, April, 1893, p. 34).

The oil is a powerful irritant and vesicant, but has been used in minute quantities for imparting flavor to pickles and sauces. One part of the oil represents the strength of about 1600 parts of garlic.

Oil of Geranium or Rose Geranium.

(German: Geranium-Oel.)

Distilled from the herb of several species of *Pelargonium*, especially *P. Radula* Aiton, *P. capitatum* Aiton, and *P. odoratissimum* Linné (Nat. Ord. *Geraniaceæ*).

The following varieties of this oil are distinguished in commerce:

<i>Algerian.</i>	Specific gravity	0.890 to 0.898.	Optical rotation	—7° to — 9°
<i>French.</i>	“	“ 0.894 to 0.899.	“	“ —9° to —12°
<i>Réunion.</i>	“	“ 0.886 to 0.895.	“	“ —8° to —11°
<i>Spanish.</i>	“	“ about 0.898.	“	“ about — 8°

An oil distilled by Messrs. Schimmel & Co., from plants cultivated in Leipsic, had a specific gravity of 0.906, and an optical rotation of —16°.

The above oils have a pale yellowish or greenish (Réunion) color, and an exceedingly agreeable, rose-like odor, which render them valuable in perfumery. The chief constituent of the oils is geraniol, $C_{10}H_{17}OH$ (see the latter, under Chemical Preparations, Part III), which is present in amounts of about 80 to 85 per cent. The geraniol is contained in the oils in the form of esters, among which that of tiglic acid predominates (see Schimmel & Co.'s *Bericht*, April, 1894, p. 31).

An excellent test for the purity of the Geranium Oils, and which may serve to detect adulterations with fatty oils, petroleum, oil of

turpentine, etc., is their property of forming a perfectly clear solution with two or three times their volume of 70 per cent. alcohol.

Oil of Geranium, East Indian.

(German: Geranium-Oel, Indisches.)

This is the so-called *Turkish Geranium* or *Palmarosa Oil*.

It is distilled in the northern provinces of India from the grass of a species of *Andropogon* (regarded as *A. Schænanthus* Linné). Nat. Ord. *Gramineæ*.

A nearly colorless, or pale yellowish liquid. Specific gravity 0.890 to 0.900. Optically inactive or slightly lævogyrate (0° to about -2°). It consists chiefly of geraniol or its esters, and, like the preceding oils of geranium, is soluble in two or three times its volume of 70 per cent. alcohol.

The oil is valued chiefly for its agreeable perfume.

Oil of Ginger.

(German: Ingwer-Oel.)

Distilled from the rhizome of *Zingiber officinale* Roscoe (Nat. Ord. *Scitamineæ*).

The oil has a pale yellowish color, the characteristic odor of ginger, and an aromatic, somewhat burning taste. Specific gravity 0.880 to 0.885. Optical rotation -25° to -40°. Its chemical constituents have not yet been sufficiently investigated, but Messrs. Schimmel & Co. (*Bericht*, October, 1893, p. 22, and April, 1894, p. 33) have shown it to contain *camphene* and *phellandrene*.

It is used chiefly in the preparation of liquors.

Oil of Ginger Grass.

(German: Gingergrass-Oel.)

This appears to be derived from the same botanical source as the East Indian or so-called Turkish Geranium Oil (see above). It is, however, a less valuable product, and is often grossly adulterated, especially with fatty oils (see Schimmel & Co.'s *Bericht*, April, 1894, p. 31).

Oil of Golden Rod.

(German: Goldruthen-Oel.)

Distilled from the herb of *Solidago odora* Aiton (Nat. Ord. *Compositæ*).

This is the oil of the so-called "sweet-scented golden rod." It has a pale greenish-yellow color, and a strongly aromatic odor. Specific gravity 0.963. It appears not to have been further examined.

No less than 40 distinct species of *Solidago*, or "Golden Rod," occur in North America, east of the Rocky Mountains. In addition to the above mentioned species, we have distilled the flowering herb of *Solidago Canadensis* Linné. This yields a pale yellowish-green oil, having an agreeably aromatic odor. Specific gravity 0.859. Optical rotation $-11^{\circ} 10'$. A partial examination of the oil, made in our Garfield laboratories, has shown it to consist chiefly of terpenes, among which pinene and phellandrene have thus far been identified.

Oil of Ground Ivy.

(German: Gundermannkraut-Oel.)

Distilled from the dried herb of *Glechoma hederacea* Linné (Nat. Ord. *Labiatae*).

The oil has a dark green color, and an odor which is difficult to define, but by no means agreeable. Specific gravity 0.925.

Oil of Guaiacum Wood.

(German: Guaiacholz-Oel.)

Distilled from the wood of an undetermined species of *Guaiacum* from South America, where it is known as "Balsam Wood" (*Palo balsamo*).

The oil is exceptionally thick and viscid, has an exceedingly agreeable violet- and tea-like odor, and at ordinary temperatures assumes a crystalline character. The crystalline body is of alcoholic nature, melts at 91°C. , and appears to have the composition $\text{C}_{14} \text{H}_{24} \text{O}$ or $\text{C}_{15} \text{H}_{26} \text{O}$.

The oil is valuable as a perfume, and is used in both floral extracts and soaps.

An oil recently brought into commerce under the fanciful name of "Champaca Oil" or "Champaca-wood Oil" has not the slightest similarity with true Champaca Oil (see the latter) from the flowers of *Michelia Champaca* Linné (Nat. Ord. *Magnoliaceae*), but is perfectly identical with the above described Guaiacum Wood Oil. The so-called "Champakol" is also nothing more than the above described crystalline alcohol. (See Schimmel & Co.'s *Bericht*, April, 1892, p. 42, and April, 1893, p. 32.)

Oil of Hedychium.

(German: Hedychium-Oel.)

Distilled in Java from the flowers of *Hedychium Coronarium* Linné.

It has an exceedingly pleasant, but very mild odor. Specific gravity 0.869. Optical rotation $-0^{\circ} 28'$.

Oil of Helichrysum.

(German: Helichrysum-Oel.)

Distilled from the flowering herb of *Helichrysum Stoechas* (Nat. Ord. *Compositae*).

It has an odor reminding of oils from the *Coniferae*. Specific gravity 0.873. It boils chiefly between 155° and 170° C., and probably contains considerable pinene.

Oil of Hemlock.

(German: Hemlocktannen-Oel.)

Distilled from the leaves and twigs of *Tsuga canadensis* Carr. (*Abies Canadensis* Michx.). Nat. Ord. *Coniferae*.

A colorless liquid, of agreeable odor, much resembling the Oil of Spruce, and probably similar to the latter in composition. Specific gravity about 0.913. Optical rotation $-23^{\circ} 55'$.

This oil appears to be frequently confused with the true Oil of Spruce from the fact that the tree affording it is sometimes known as "Hemlock Spruce." It appears not to have been chemically examined. The true Oil of Spruce (see the latter) is obtained from a different botanical source.

Oil of Heracleum.

(German: Heracleum-Oel.)

Distilled from the fruit of *Heracleum Sphondylium* Linné (Nat. Ord. *Umbelliferae*).

The oil has a pale yellow color, and an acid reaction. Specific gravity 0.80 to 0.87. It boils between 80° and 300° C., and contains a number of esters. The following compounds are stated to be contained in the oil: ethyl and butyl acetates, ethyl and hexyl alcohols, and octyl capronate. (See Liebig's *Annalen*, 152, 1869, p. 1; 185, 1877, p. 26; and *Ber. d. deutsch. chem. Ges.*, 9, 1876, p. 998.)

Oil of Hops.

(German: Hopfen-Oel.)

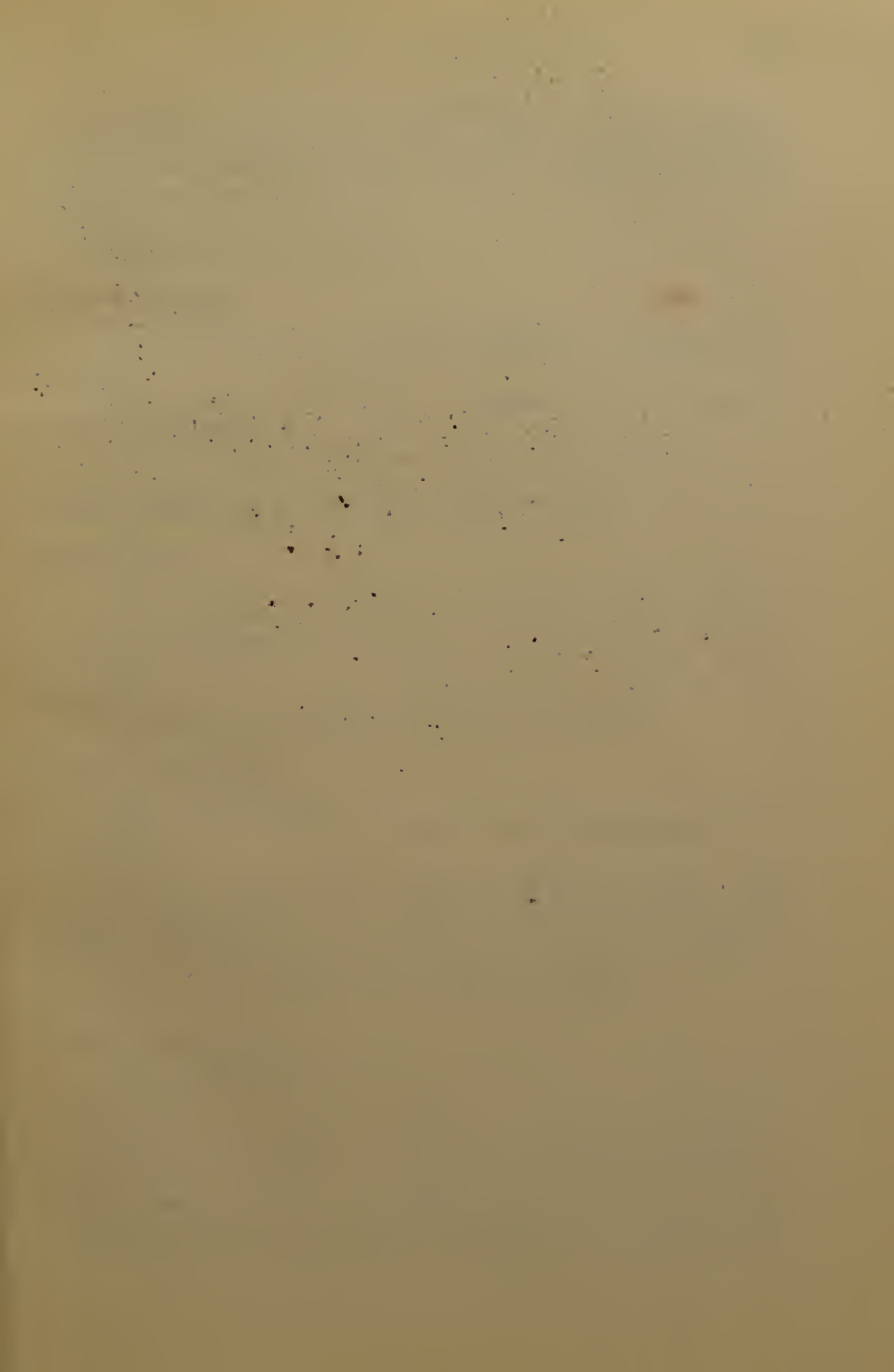
Distilled from the strobiles of *Humulus Lupulus* Linné (Nat. Ord. *Urticaceae*).

The oil has a greenish color, and a strong, penetrating odor of hops. Specific gravity 0.855 to 0.880. Its constituents have not yet been sufficiently examined. It has been used for imparting aroma to beer.

Oil of Horsemint.

(German: Monarden-Oel.)

Distilled from the herb of *Monarda punctata* Linné (Nat. Ord. *Labiatae*).



The oil has a yellowish-red or brownish-red color, and a strong, thyme-like odor. Specific gravity 0.920 to 0.936. It contains thymol, a terpene, and apparently the formic, acetic and butyric esters of an alcohol of the composition $C_{10}H_{18}O$. (See *Amer. Journ. Pharm.*, 1888, p. 120.)

It is used chiefly in liniments.

Oil of Hyssop.

(German: Isop-Oel.)

Distilled from the herb of *Hyssopus officinalis* Linné (Nat. Ord. *Labiatae*).

Specific gravity about 0.932. It appears not to have been chemically examined.

It is used medicinally, and in the preparation of liquors.

Oil of Imperatoria, see Oil of Masterwort.

Oil of Iva.

(German: Iva-Oel.)

Distilled from the flowering herb of *Achillea moschata* Wulfen (Nat. Ord. *Compositae*).

A very aromatic oil, of a bluish-green color. Specific gravity about 0.934.

It is used in the preparation of the Swiss Iva liquor.

Oil of Jaborandi.

(German: Jaborandi-Oel.)

Distilled from the leaves of *Pilocarpus pennatifolius* Lemaire (Nat. Ord. *Rutaceae*).

The oil has a bright yellow color, a penetrating odor, and a mild taste. Specific gravity 0.875. It boils between 180° and 290° C. The portion distilling above 260° C. solidifies in the cold, and contains a solid paraffin-like substance which melts at 27° to 28° C.

No use appears to have yet been made of this oil.

Oil of Kæmpferia.

(German: Kæmpferia-Oel.)

Distilled in Java from the rhizome of *Kæmpferia rotunda* Linné (Nat. Ord. *Zingiberaceae*).

The oil has a yellow color, and an odor which is at first camphor-like, afterward reminding of estragon oil. Specific gravity 0.945. Optical rotation $+13^{\circ} 4'$. The only constituent of the oil thus far identified is cineol, but the odor indicates that it may also contain methyl-chavicol. (See Schimmel & Co.'s *Bericht*, April, 1894, p. 57.)

Oil of Kesso, see **Oil of Valerian, Japanese.**

Oil of Kiku.

(German: Kiku-Oel.)

Distilled in Japan from the leaves of *Pyrethrum indicum* Cass. (Nat. Ord. *Compositae*).

A colorless oil, having a camphor-like odor, reminding somewhat of eucalyptus. Specific gravity 0.885. It boils between 165° and 175° C.

The oil is an esteemed domestic remedy in Japan, where it is known as *Abura-Kuku*.

Oil of Kuro-moji.

(German: Kuromoji-Oel.)

Distilled in Japan from the wood of *Lindera sericea* Blume (Nat. Ord. *Lauraceae*).

The oil has a fine, aromatic, balsamic odor. Specific gravity 0.892. Optical rotation $-0^{\circ} 4'$. It contains dextrogyrate limonene, dipentene, terpineol, and lævogyrate carvol. (See *Ber. d. deutsch. chem. Ges.*, 24, 1891, p. 81.)

It is of value in perfumery, and especially for perfuming soaps.

Oil of Ladanum.

(German: Ladanum-Oel.)

Distilled from the gum-resin of *Cistus creticus* Linné (Nat. Ord. *Cistaceae*).

The oil has a golden-yellow color, and a fine, ambergris-like odor. Specific gravity 1.011. It separates a crystalline body on standing. The oil has not yet been chemically examined, but is doubtless of value in perfumery.

Oil of Laurel.

(German: Lorbeer-Oel.)

Distilled from the leaves or the berries of *Laurus nobilis* Linné (Nat. Ord. *Lauraceae*).

This oil, whether obtained from the leaves or berries, appears to be essentially the same, although that from the leaves has the finer aroma. Specific gravity 0.924 (from leaves), 0.925 (from berries). Both oils contain pinene and cineol, and apparently a sesquiterpene. (See Liebig's *Annalen*, 252, p. 94.)

Oil of Laurel, Californian.

(German: Lorbeer-Oel, Californisches.)

Distilled from the leaves of *Oreodaphne Californica* (Nat. Ord. *Lauraceae*).

A bright yellow liquid, having an aromatic odor. Specific gravity 0.947. It contains cineol, and other not sufficiently determined constituents.

Oil of *Ledum palustre*, see Oil of Marsh Tea.

Oil of Lemongrass.

(German: Lemongrass-Oel.)

Distilled in the East Indies from the grass of a species of *Andropogon*, regarded as *A. citratus* DC. (Nat. Ord. *Gramineæ*).

This oil is also known as *Oil of Verbena*, *East Indian*, or *Indian Melissa Oil*. It has a yellowish or yellowish-brown color, or, when rectified, is nearly colorless, and possesses a fragrant odor, reminding of lemon and verbena. Specific gravity 0.895 to 0.905. It contains citral. The oil should form a clear solution with twice its volume of 70 per cent. alcohol.

It is valued for its agreeable perfume.

Oil of *Levisticum*, see Oil of Lovage.

Oil of Limes.

(German: Limette-Oel.)

Obtained by expression from the rind of the fresh fruit of *Citrus Limetta* Risso (Nat. Ord. *Rutaceæ*).

A golden-yellow liquid, having an exceedingly refreshing odor. Specific gravity 0.882. Optical rotation $+35^{\circ}$ to $+40^{\circ}$. It contains citral and limonene.

This oil is very valuable in perfumery, and is not to be confused with distilled oils of inferior quality.

Oil of Linaloe.

(German: Linaloe-Oel.)

Distilled in Mexico from a wood of uncertain botanical origin.

A colorless, fragrant liquid. Specific gravity 0.875 to 0.890. Optically dextrogyrate or lævogryrate. It contains chiefly linalool $C_{10}H_{18}O$ (see the latter, under Chemical Preparations, Part III), and a small amount of its isomer, geraniol (*Ber. d. deutsch. chem. Ges.*, 24, 1891, p. 207).

The oil is of value in perfumery.

Oil of Lovage.

(German: Liebstock-Oel.)

Distilled from the root, fruit, or herb of *Levisticum officinale* Koch (Nat. Ord. *Umbelliferae*).

The oils differ in specific gravity, that from the root being 1.03 to 1.04, from the fruit 0.935, and from the fresh herb 0.928. They

have the characteristic odor of the plant, but have not yet been chemically examined.

Oil of Mace.

(German: Macis-Oel.)

Distilled from the arillode of the seed of *Myristica fragrans* Houttuyn (Nat. Ord. *Myristicaceae*).

A colorless or pale yellowish liquid, having an agreeable, aromatic odor. Specific gravity 0.91 to 0.93. Optical rotation $+10^{\circ}$. It contains pinene, dipentene, myristicol $C_{10}H_{16}O$, and myristicin $C_{12}H_{14}O_3$ (see *Ber. d. deutsch. chem. Ges.*, 23, p. 1803). Compare also *Oil of Nutmeg*, Part I.

Oil of Marjoram, Sweet.

(German: Majoran-Oel.)

Distilled from the herb of *Origanum Majorana* Linné (Nat. Ord. *Labiatae*).

The oil has a yellowish or greenish-yellow color, and a strong, penetrating odor. Specific gravity 0.890 to 0.900. Optical rotation $+17^{\circ} 10'$.

The chemical composition of this oil has not yet been determined with sufficient accuracy. It is used medicinally, and for perfuming soaps.

Oil of Marjoram, Wild.

(German: Dosten-Oel.)

Distilled from the herb of *Origanum vulgare* Linné (Nat. Ord. *Labiatae*).

The oil has a yellow color, a strongly aromatic odor, and bitter, spicy taste. Specific gravity 0.893.

It has not yet been sufficiently examined chemically.

Oil of Marsh Tea.

(German: Porsch-Oel.)

Distilled from the herb of *Ledum palustre* Linné (Nat. Ord. *Ericaceae*).

The oil has a pale reddish-yellow color, and a penetrating odor. Specific gravity 0.932. It boils between 180° and 250° C. The chief constituent is said to be ledum camphor $C_{15}H_{26}O$, accompanied by a sesquiterpene $C_{15}H_{24}$. Messrs. Schimmel & Co. did not succeed in obtaining the above mentioned camphor from a normal oil of their own distillation, nor from the various fractions of it, even by exposure to cold. (See *Bericht*, October, 1887, p. 35; also *Ber. d. deutsch. chem. Ges.*, 8, 1875, p. 542, and 16, 1883, p. 2311.)

Oil of Massoy Bark.

(German: Massoyrinden-Oel.)

Distilled from the bark, occurring in New Guinea, of *Massoia aromatica* Beccari (Nat. Ord. *Lauraceæ*).

The oil has a yellow color, an agreeable, spicy odor, reminding of clove and nutmeg, and a sharp, burning taste. Specific gravity 1.058. It contains about 75 per cent. of eugenol, together with safrol, pinene, limonene, and dipentene. (See *Archiv der Pharm.*, 1890, p. 22, and Liebig's *Annalen*, Bd. 258, p. 340.)

It is recommended as a perfume for soaps, etc.

Oil of Masterwort.

(German: Meisterwurz-Oel.)

Distilled from the root of *Imperatoria Ostruthium* Linné (Nat. Ord. *Umbelliferae*).

The oil has a strongly aromatic odor, reminding of Angelica, and a biting, aromatic taste. Specific gravity 0.877. It boils between 170° and 190° C., and appears to consist chiefly of hydrocarbons, which have not been further examined.

Oil of Mastic.

(German: Mastix-Oel.)

Distilled from Mastic, a resinous exudation from *Pistacia Lentiscus* Linné (Nat. Ord. *Anacardiaceæ*).

The oil has a yellow color, and a characteristic, strongly balsamic odor of the drug. Specific gravity 0.858. Optical rotation +25°.

It appears to consist chiefly of terpenes.

Oil of Matico.

(German: Matico-Oel.)

Distilled from the leaves (and the flowers) of *Piper angustifolium* R. et P. (Nat. Ord. *Piperaceæ*).

The oil has a yellowish-brown color, and a peculiar odor. The specific gravity of the oil from the leaves is 0.93, while that from the flowers is 1.13. The best known constituent of the oil is the so-called matico camphor $C_{12}H_{20}O$. (See *Ber. d. deutsch. chem. Ges.*, 16, 1883, p. 2841.)

Oil of Melissa.

(German: Melissen-Oel.)

The true Oil of Melissa, from *Melissa officinalis* Linné (Nat. Ord. *Labiatae*), commonly known as Balm, is not an article of commerce. The article known under this name, or as *Oleum Melissa citratum*, is obtained by distilling the leaves of the melissa with lemon oil.

Oil of Melissa, East Indian, see **Oil of Lemongrass.**

Oil of Mew.

(German: Baerwurz-Oel.)

Distilled from the root of *Meum athamanticum* Jacq. (Nat. Ord. *Umbelliferae*).

The oil has a dark yellow color, and an odor reminding of lovage. Specific gravity 0.999 at 21° C. It boils between 170° and 300° C., yielding finally a greenish-blue fraction. It easily becomes resinified on boiling, but appears not to have been chemically examined.

Oil of Mignonette, see **Oil of Reseda.**

Oil of Milfoil.

(German: Schafgarben-Oel.)

Distilled from the fresh flowering herb of *Achillea Millefolium* Linné (Nat. Ord. *Compositae*), known also as Yarrow.

The oil has a yellowish, green, or bluish color, a penetrating odor, and an aromatic, camphor-like taste. Specific gravity 0.910 to 0.920. It appears not to have been chemically examined. It is used to a small extent medicinally.

Oil of Mint, Mountain, see **Oil of Mountain Mint.**

Oil of Mint, Water, see **Oil of Water Mint.**

Oil of Mint, Wild, see **Oil of Wild Mint.**

Oil of Monarda, see **Oil of Horsemint.**

Oil of Mosoi Flowers, see **Oil of Cananga.**

Oil of Mountain Mint.

(German: Pycnanthemum-Oel.)

Distilled from the dried herb of *Pycnanthemum incanum* Michaux (Nat. Ord. *Labiatae*).

The oil has a reddish yellow color, and a strongly aromatic odor. Specific gravity 0.935. It is soluble in twice its volume of 70 per cent. alcohol, but has not yet been chemically examined.

Oil of Mugwort, see **Oil of Artemisia vulgaris.**

Oil of Musk Root, see **Oil of Sumbul.**

Oil of Musk Seed, see **Oil of Ambrette Seed.**

Oil of Myrrh.

(German: Myrrhen-Oel.)

Distilled from Myrrh, a gum-resin obtained from *Commiphora Myrrha* (Nees) Engler (Nat. Ord. *Burseraceae*).

The oil is a yellowish, rather viscid liquid, having a strong odor of the drug. Specific gravity 0.990 to 1.010. Optical rotation $-60^{\circ} 2'$. It distills chiefly between 270° and 290° C., but its constituents have not been more exactly identified (see *Pharmacographia*, 2 Edit., p. 144).

Oil of Myrtle, Spanish.

(German: Myrten-Oel.)

Distilled from the leaves of *Myrtus communis* Linné (Nat. Ord. *Myrtaceae*).

The oil has a light yellow color, and an agreeably aromatic odor. Specific gravity 0.89 to 0.92. Optically dextrogyrate. It contains cineol, dextrogyrate pinene, and dipentene (see *Archiv der Pharm.*, Bd. 227, p. 174). It has been used medicinally as an antiseptic, in diseases of the respiratory organs and the bladder, and as a local application in rheumatic affections. See also *Myrtol*, under Chemical Preparations, Part III.

Oil of Niobe, see **Methyl Benzoate**, under Chemical Preparations, Part III.

Oil of Olibanum.

(German: Olibanum-Oel or Weihrauch-Oel.)

Distilled from Olibanum, a gum-resin obtained from species of *Boswellia* (Nat. Ord. *Burseraceae*).

A colorless liquid, having an agreeable, balsamic odor. Specific gravity 0.875 to 0.885. Optical rotation $-11^{\circ} 35'$. It consists chiefly of lævogyrate pinene, with some phellandrene, dipentene, and oxygenated bodies (see Liebig's *Annalen*, 252, 1889, p. 94). The oil is considered of value in mixtures of soap perfumes, and as a constituent of fumigating tinctures.

Oil of Onion.

(German: Zwiebel-Oel.)

Distilled from the fresh herb and bulb of the common onion *Allium Cepa* Linné (Nat. Ord. *Liliaceae*).

The oil has a reddish-brown color. Specific gravity 1.040. Optical rotation -5° . It contains the compound $C_6H_{12}S_2$, and appears to resemble in its general characters and composition the *Oil of Garlic*, see the latter.

Oil of Opoponax.*(German: Opoponax-Oel.)*

Distilled from Opoponax, a gum-resin obtained from *Opoponax Chironium* Koch (Nat. Ord. *Umbelliferae*).

The oil has a greenish-yellow color, and an agreeable, balsamic odor. It resinifies quickly on exposure to the air. Specific gravity 0.860 to 0.910. It boils between 200° and 300° C., the lower boiling portions representing the characteristic odor of the oil, but has not yet been chemically examined. It appears to be of value in perfumery.

Oil of Origanum, Cretian (*Oleum Origanii Cretici*).*(German: Spanisch Hopfen-Oel.)*

Distilled from the herb of several species or varieties of *Origanum* grown in the Orient, such as *O. creticum* Linné, *O. megastachyum*, Lk., *O. macrostachyum* Lk., and *O. hirtum* Lk. (Nat. Ord. *Labiatae*).

The oil when freshly rectified has a golden-yellow color, but on keeping, or on exposure to the air, gradually acquires a reddish or reddish-brown color. It has a penetrating, aromatic, thyme-like odor. Specific gravity 0.960 to 0.980. Its chief constituent is carvacrol, of which it sometimes contains as much as 80 per cent., and a good oil should not contain less than 50 per cent. of this body. (See *Carvacrol*, under Chemical Preparations, Part III.) The above oil, when pure, is not colorless, and, in order to retain it of a light yellow color for microscopical purposes, it should be kept in a dark place, and in well-stoppered bottles, which should be as completely filled as possible.

Oil of Origanum, French, see Oil of Marjoram, Wild.**Oil of Orris.***(German: Iris-Oel or Veilchenwurzel-Oel.)*

Distilled from the rhizomes of the following species of Iris:

I. germanica Linné, *I. pallida* Lam., and *I. florentina* Linné (Nat. Ord. *Iridaceae*).

This oil is solid at ordinary temperatures. It consists of myristic acid $C_{14}H_{28}O_2$, associated with a relatively small amount of liquid substance to which its exquisite and persistent fragrance is due.

The constituent of orris root, or of the essential oil of orris, which possesses the characteristic, violet-like odor has recently been isolated by Tiemann and Krüger (see *Ber. d. deutsch. chem. Ges.*, 26, 1893, pp. 2675-2708). This body, which has been termed *irone*, is a ketone of the composition $C_{13}H_{26}O$. It distills at 144° C., under a pressure

of 14 Mm., has a specific gravity of 0.939 at 20° C., and is dextro-rotatory. By the elimination of the elements of water it is converted into a hydrocarbon termed *irene* $C_{13}H_{18}$.

The oil of orris distilled by Messrs. Schimmel & Co. has been found to contain from 10 to 15 per cent. of irone.

A body having the same empirical composition as irone, and structurally isomeric with it, has also been obtained by the above mentioned chemists by synthetic means, and is termed *ionone*. This is prepared by the condensation of citral and acetone, whereby the so-called pseudo-ionone is first obtained, and the latter, by treatment with dilute sulphuric acid, suffers a molecular change, becoming converted into the isomeric *ionone*.

Ionone, $C_{13}H_{20}O$, distills between 126° and 128° C. under a pressure of 12 Mm., has a specific gravity of 0.9351 at 20° C., and is optically inactive. By the elimination of the elements of water it is converted into a hydrocarbon termed *ionene*, $C_{13}H_{18}$.

Ionone possesses in a remarkable degree of purity and concentration the characteristic, fragrant odor of fresh violets. This odor is only fully developed when the substance is in a diluted state, and ionone is therefore brought into commerce in the form of a ten per cent. alcoholic solution. It is thus adapted for use in floral extracts, toilet soaps, and other perfumed articles.

Oil of Palmarosa, see Oil of Geranium, East Indian.

Oil of Para Coto Bark, see Oil of Coto Bark, Para.

Oil of Parsley.

(German: Petersilien-Oel.)

Distilled from the fruit of *Petroselinum sativum* Hoffm. (Nat. Ord. *Umbelliferae*).

A colorless or pale greenish-yellow liquid, having a strong odor of parsley. Specific gravity 1.07. It contains lævogyrate pinene and apiol $C_{12}H_{14}O_1$ (see the latter, under Chemical Preparations, Part III).

The oil is used occasionally as a diuretic.

Oil of Parsley Root has also been distilled by Messrs. Schimmel & Co. The yield is very small, amounting to but 0.08 per cent. of the dry root. The oil has a specific gravity of 1.049. At ordinary temperatures it separates crystals, which probably consist of apiol.

Oil of Parsnip.

(German: Pastinac-Oel.)

Distilled from the fruit of *Pastinaca sativa* Linné (Nat. Ord. *Umbelliferae*).

The oil has a yellowish color, and a characteristic, agreeable odor. Specific gravity 0.870 to 0.890. It contains the octyl esters of propionic and butyric acids.

Oil of Patchouly.

(German: Patchouli-Oel.)

Distilled from the leaves of *Pogostemon Patchouli* Pellet. (Nat. Ord. *Labiatae*).

A yellowish-green or brown, somewhat thick liquid, having a penetrating and exceedingly persistent odor. Specific gravity 0.97 to 0.99. It contains cadinene $C_{15}H_{24}$, and patchouly alcohol, or so-called "patchouly camphor" $C_{15}H_{26}O$ (see Liebig's *Annalen*, 150, 1869, p. 374; 238, 1887, p. 81; *Compt. rend.*, 84, 1877, p. 88).

An oil distilled in Java from a species of *Pogostemon* closely related to the above has a yellowish color and an odor reminding of patchouly, but agreeably modified by the presence of a substance having an odor resembling anise-aldehyde. The specific gravity of this oil is 0.961. Optical rotation $-32^{\circ} 17'$. It is said, under some circumstances, to deposit a stearopten (see Schimmel & Co.'s *Bericht*, April, 1894, p. 58).

Oil of Pear, see **Amyl Acetate**, under

Chemical Preparations, Part III.

Oil of Pennyroyal, European, see under

Oil of Hedeoma, Part I.

Oil of Pepper.

(German: Pfeffer-Oel.)

Distilled from Black Pepper, the fruit of *Piper nigrum* Linné (Nat. Ord. *Piperaceae*).

A yellowish, limpid liquid, having a strongly pungent, pepper-like odor and taste. Specific gravity 0.880 to 0.905. It contains phellandrene $C_{10}H_{16}$, and cadinene $C_{15}H_{24}$ (see *Archiv der Pharm.*, 1887, p. 515, and Schimmel & Co.'s *Bericht*, October, 1890, p. 39).

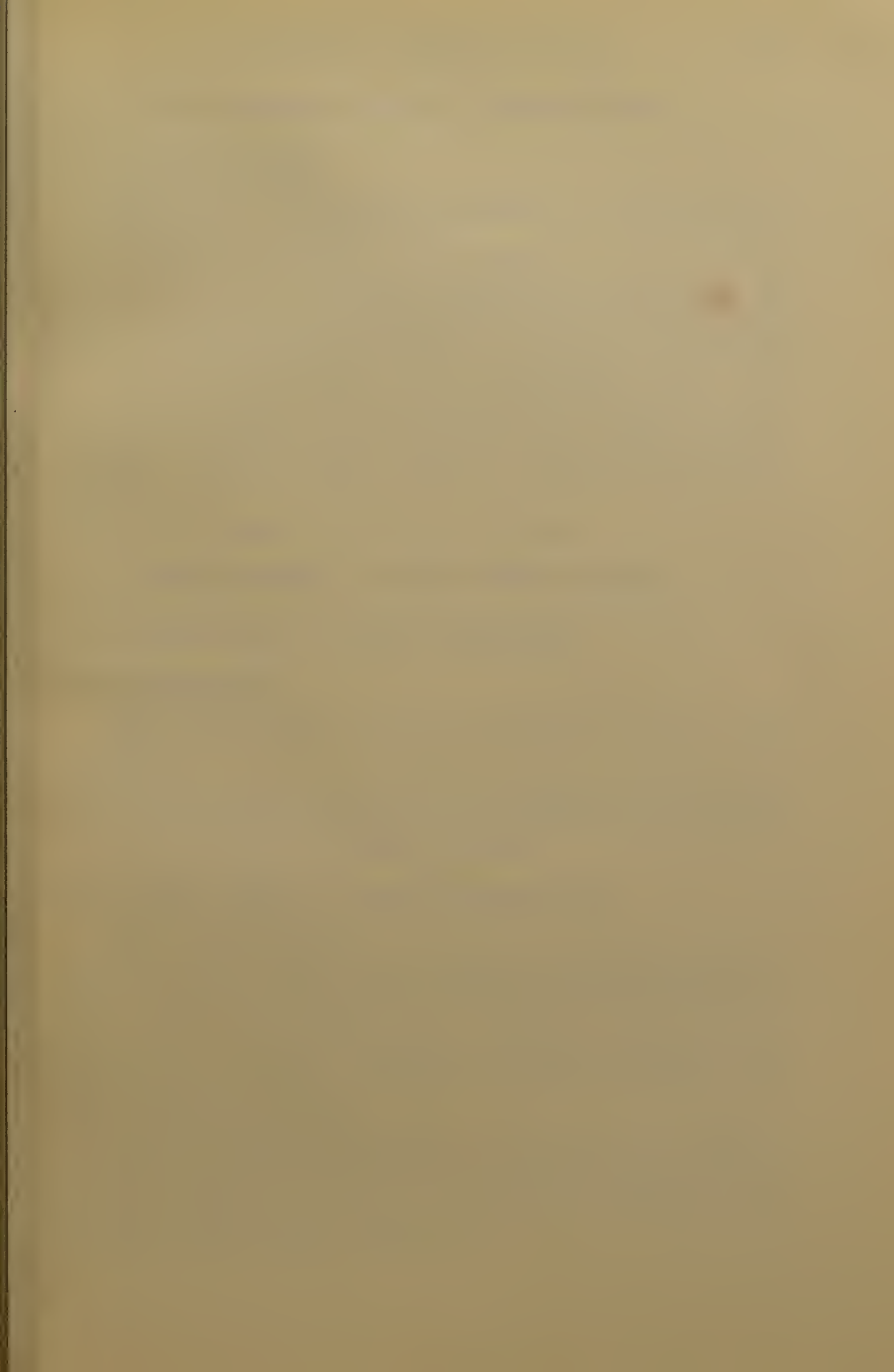
Long Pepper, the fruit of *Piper longum* Linné, yields a thickish oil, of a light green color, and an odor reminding more of ginger. Specific gravity 0.861. It boils between 250° and 300° C.

Oil of Pepper, Japanese.

(German: Pfeffer-Oel, Japanisches.)

Distilled from the fruit of *Xanthoxylum piperitum* DC. (Japanese: "Sansho"), Nat. Ord. *Rutaceae*.

The oil has a yellowish color, and an agreeable lemon-like odor and taste. Specific gravity 0.973. It boils between 160° and 230° C., and contains a terpene and citral.



Oil of Peru Balsam, see Oil of Balsam Peru.

Oil of Petit Grains.

(German: Petitgrains-Oel.)

Distilled from the leaves and unripe fruits of *Citrus Bigaradia* Duhamel (Nat. Ord. *Rutaceæ*).

A yellowish liquid, having an odor reminding of the oil of orange flowers (neroli), but not nearly so fine. Specific gravity 0.890-0.900. It contains the acetic ester of an alcohol which is either isomeric with linalool, or most probably identical with it. This is not the only body to which the aroma of the oil is due, but it appears to be a very essential one. Messrs. Schimmel & Co. (*Bericht*, April, 1894, p. 39) have found the amount of ester in Paragnay oils to vary from 50 to 86 per cent., and that the oils containing the most ester are richest in perfume. The oil is soluble in twice its volume of 80 per cent. alcohol.

Oil of Petit Grains is used only as a perfume.

Oil of Phellandrium, see Oil of Water Fennel.

Oil of Pilocarpus, see Oil of Jaborandi.

Oil of Pimpinella.

(German: Pimpinell-Oel.)

Distilled from the root of *Pimpinella Saxifraga* Linné (Nat. Ord. *Umbelliferae*).

The oil has a yellow color, and a penetrating, parsley-like odor. Specific gravity 0.959. It boils between 240° and 310° C., but appears not to have been further examined chemically.

Oil of Pinus Abies or Norway Spruce Fir.

(German: Fichtennadel-Oel.)

Distilled from the leaves and twigs of *Pinus Abies* Linné (*Pinus excelsa* Lk., *Abies excelsa* DC., *Picea vulgaris* Lk.), Nat. Ord. *Coniferae*.

The oil has a characteristic, and exceedingly agreeable odor. Specific gravity 0.888. Optical rotation $-21^{\circ} 40'$. It contains lævogyrate pinene, lævogyrate phellandrene, dipentene, cadinene and lævogyrate bornyl acetate. The amount of ester, calculated as bornyl acetate, is about 8.3 per cent.

The interesting investigations on the coniferous oils here described, conducted by Drs. Bertram and Walbaum in the laboratory of Schimmel & Co., Leipsic, are contained in the *Archiv der Pharm.*, 1893, pp. 290-305. See also Schimmel & Co.'s *Bericht*, October, 1892, p. 21, April, 1893, p. 29, and October, 1893, p. 19.

Oil of *Pinus Ledebourii* or Siberian Larch.*(German: Sibirisches Fichtenadel-Oel.)*

Distilled from the leaves of *Pinus Ledebourii* Endl. (*Larix Sibirica* Ledebour), Nat. Ord. *Coniferae*.

Specific gravity 0.913. It boils at about 169° C., but appears not to have been further examined.

Oil of *Pinus Picea* or Silver Fir.*(German: Edeltannen-Oel.)*

Distilled from the leaves or the young cones of *Pinus Picea* Linné (*Abies pectinata* DC.), Nat. Ord. *Coniferae*.

The oil from the leaves has a specific gravity of 0.87 to 0.88. Optical rotation -20° to -50° . It contains pinene, limonene, cadinene, and bornyl acetate. The amount of ester, calculated as bornyl acetate, is about 4.5 per cent.

This oil has a very agreeable, refreshing odor, and is of value in perfumery.

The oil from the young cones has a specific gravity of 0.850 to 0.865. Optical rotation -55° to -80° . It contains pinene, limonene, and about 0.5 per cent. of ester, calculated as bornyl acetate (see also Wallach, in Liebig's *Annalen*, 227, p. 237).

This oil has a milder odor than that from the leaves and twigs. Its physical characters and chemical composition are also quite different.

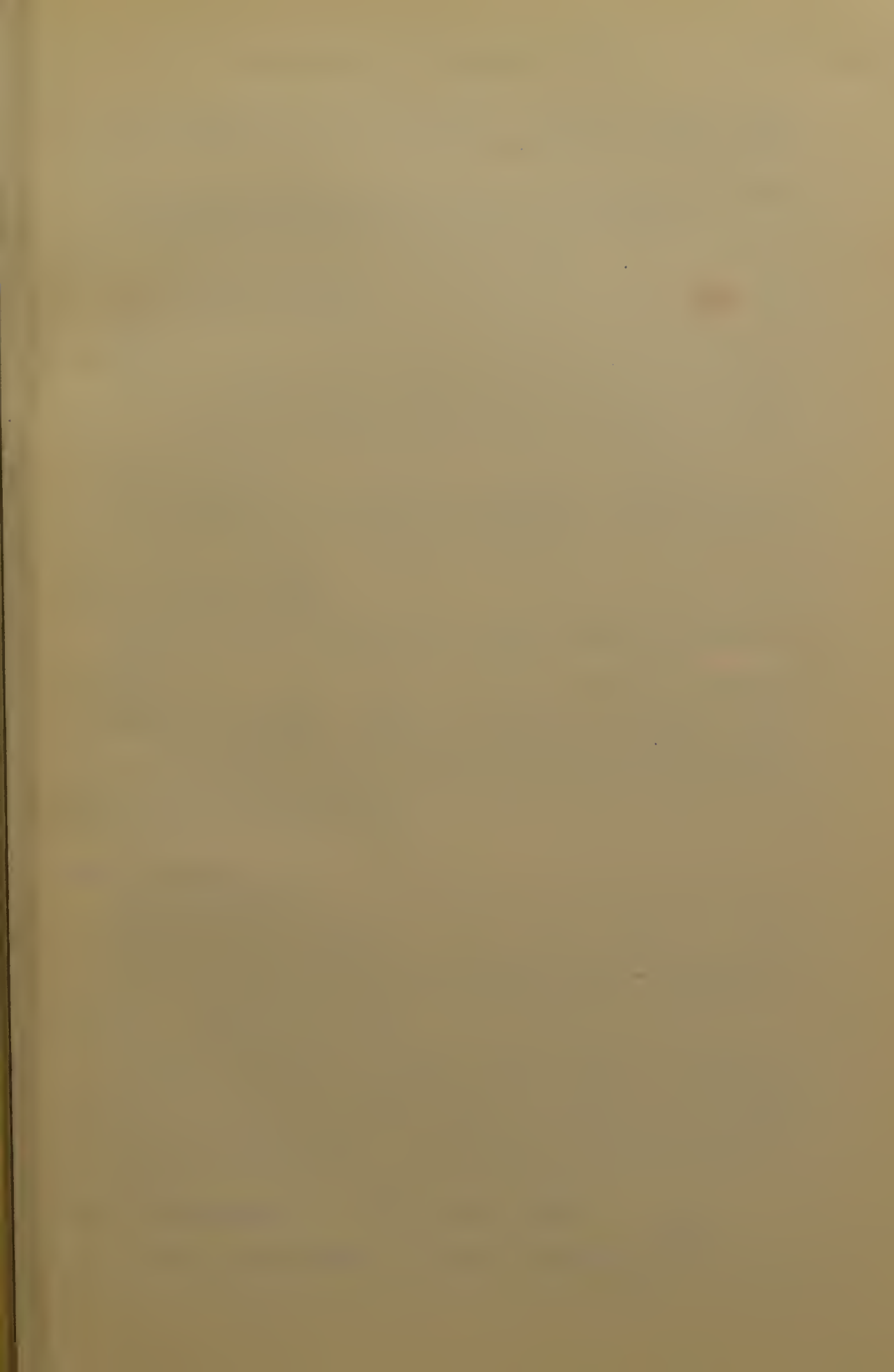
Oil of *Pinus Pumilio* or Mountain Pine*(German: Latschenkiefern-Oel or Krummholz-Oel.) (Oleum Templinum).*

Distilled from the leaves of *Pinus Pumilio* Hänke (Nat. Ord. *Coniferae*).

This oil is also known by the fanciful names of "Pumiline" and "Pinol," and by the latter designation it should not be confused with the definite chemical body $C_{10}H_{16}O$, which is an isomer of camphor, and to which the name pinol has also been applied (see Liebig's *Annalen*, 253, 1889, p. 249, and 259, 1890, p. 309).

The above oil is colorless or greenish-yellow, has a peculiar, agreeably aromatic odor, and an aromatic, bitterish taste. Specific gravity 0.865 to 0.870. Optical rotation -5° to -10° . It contains pinene, phellandrene, sylvestrene, cadinene, and bornyl acetate. The amount of ester, calculated as bornyl acetate, is about 5 to 9 per cent.

An oil distilled by Messrs. Schimmel & Co. from the fresh twigs of *Pinus Pumilio* differed somewhat in its characters from the commercial oil, which is distilled chiefly in the Tyrolese Alps. Its specific gravity was 0.892. Optical rotation -8° . Amount of ester, calculated



as bornyl acetate, 8.7 per cent., while the commercial oils contain on an average about 5 per cent. of ester (see *Bericht*, October, 1893, p. 19).

The oil has been used in many forms, both internally, externally, and for inhalations, especially in the treatment of influenza.

Oil of *Pinus Silvestris* or Scotch Pine.

(German: Kiefernadel-Oel.)

Distilled from the leaves of *Pinus silvestris* Linné (Nat. Ord. *Coniferae*).

The specific gravity of the oil from German leaves is 0.886, from Swedish leaves 0.872. Optical rotation $+10^{\circ}$ to $+10^{\circ} 40'$. It contains pinene, sylvestrene, cadinene, and bornyl acetate, the latter in amounts of about 3.5 per cent.

This oil possesses a very agreeable, and strong, pine-like odor. It is used medicinally, in the form of inhalations in lung diseases, and as an addition to baths in rheumatic affections.

Oil of Poplar Buds.

(German: Pappelknospen-Oel.)

Distilled from the dried buds of *Populus nigra* Linné (Nat. Ord. *Salicaceae*).

The oil has a bright yellow color, and a fine odor, reminding somewhat of chamomile. Specific gravity 0.900. Optical rotation $+2^{\circ}$. Boiling point 255° to 265° C. Its chemical composition corresponds to the formula $(C_5H_8)_x$, and its boiling point therefore indicates it to be a sesquiterpene $C_{15}H_{24}$ (see *Ber. d. deutsch. chem. Ges.*, 6, 1873, p. 890, and 7, 1874, p. 1485).

Oil of Reseda.

(German: Reseda-Oel.)

Distilled from the flowers of *Reseda odorata* Linné or "Mignonette" (Nat. Ord. *Resedaceae*).

This oil is solid at ordinary temperatures, and of a wax-like consistence. It appears not to have been chemically examined, but is doubtless of value in perfumery.

Oil of Reseda Root has no similarity with the oil from the flowers, but possesses a radish-like odor, and contains sulphur. It appears to belong to the group of so-called mustard oils, although not identical with ordinary mustard oil. Its specific gravity is 1.085 and optical rotation $+1^{\circ} 30'$ (see Schimmel & Co.'s *Bericht*, April, 1894, p. 55).

Oil of Rhodium, see Oil of Rose Wood.

Oil of Rose Geranium, see Oil of Geranium.

Oil of Rose Wood.

(German: Rosenholz-Oel.)

The article occurring in commerce under this name, or as "Oil of Rhodium," is a mixture of several essential oils with rose oil. The true *Oil of Rose Wood*, which is now not obtainable, but a very small specimen of which has been distilled by Messrs. Schimmel & Co., of Leipsic, is derived from the wood of *Convolvulus scoparius* Linné (Nat. Ord. *Convolvulaceæ*).

It has a handsome golden-yellow color, an exceedingly agreeable rose-like odor, and, like rose oil, solidifies at about 12° C. in needle-shaped crystals. The earlier investigations assign to this oil a specific gravity of 0.906, a lævogyrate rotation, and a boiling point of 249° C. It appears to consist chiefly of a sesquiterpene (Schimmel & Co.'s *Bericht*, April, 1887, p. 28).

Oil of Rose Wood has been used in perfumery, and as a bait for wild rabbits and rats. For the latter purpose it is said that an equally effectual preparation is a mixture of 1 part of rose oil with 20 parts of copaiba oil.

The wood of Linaloe, from French Guiana, is sometimes brought into commerce under the name of *Bois de Rose femelle*.

Oil of Rue.

(German: Rauten-Oel.)

Distilled from the leaves of *Ruta graveolens* Linné (Nat. Ord. *Rutaceæ*).

The oil has a yellowish or greenish-yellow color, and a characteristic, not specially agreeable odor. Specific gravity 0.834 to 0.840. Optical rotation about +1° to +2°. At 0° C. it solidifies to a crystalline mass. It begins to boil at about 215° C., and distills completely at about 235° C. It contains about 90 per cent. of methyl-nonyl ketone $\text{CH}_3\text{-CO-C}_9\text{H}_{19}$. The latter is a colorless liquid, having an agreeable odor, a specific gravity of 0.831, boiling point 226° to 227° C., and which solidifies at 10° C. to a crystalline mass.

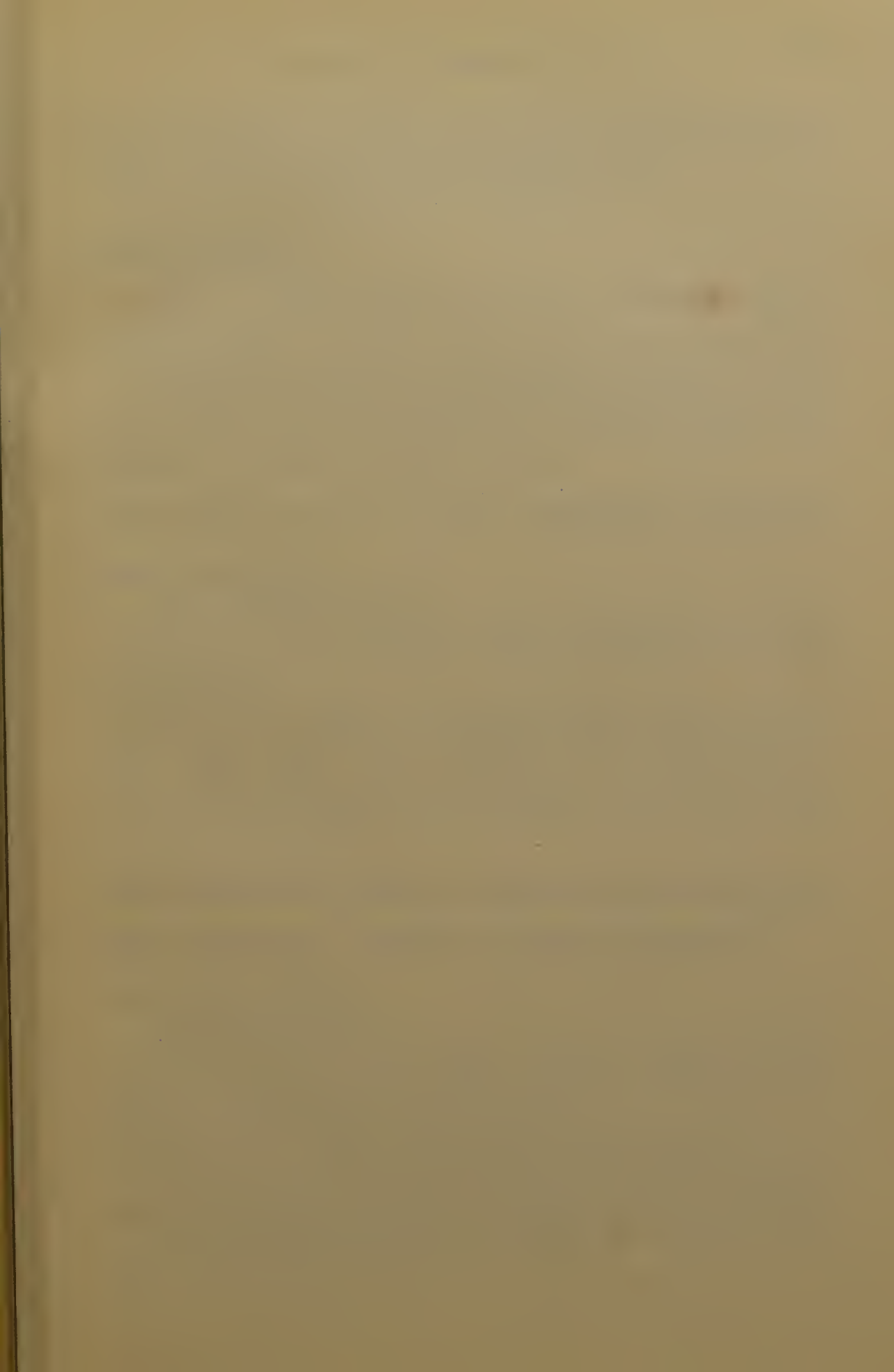
The oil is used medicinally, both internally and externally. It is frequently adulterated with oil of turpentine, petroleum, alcohol, etc.

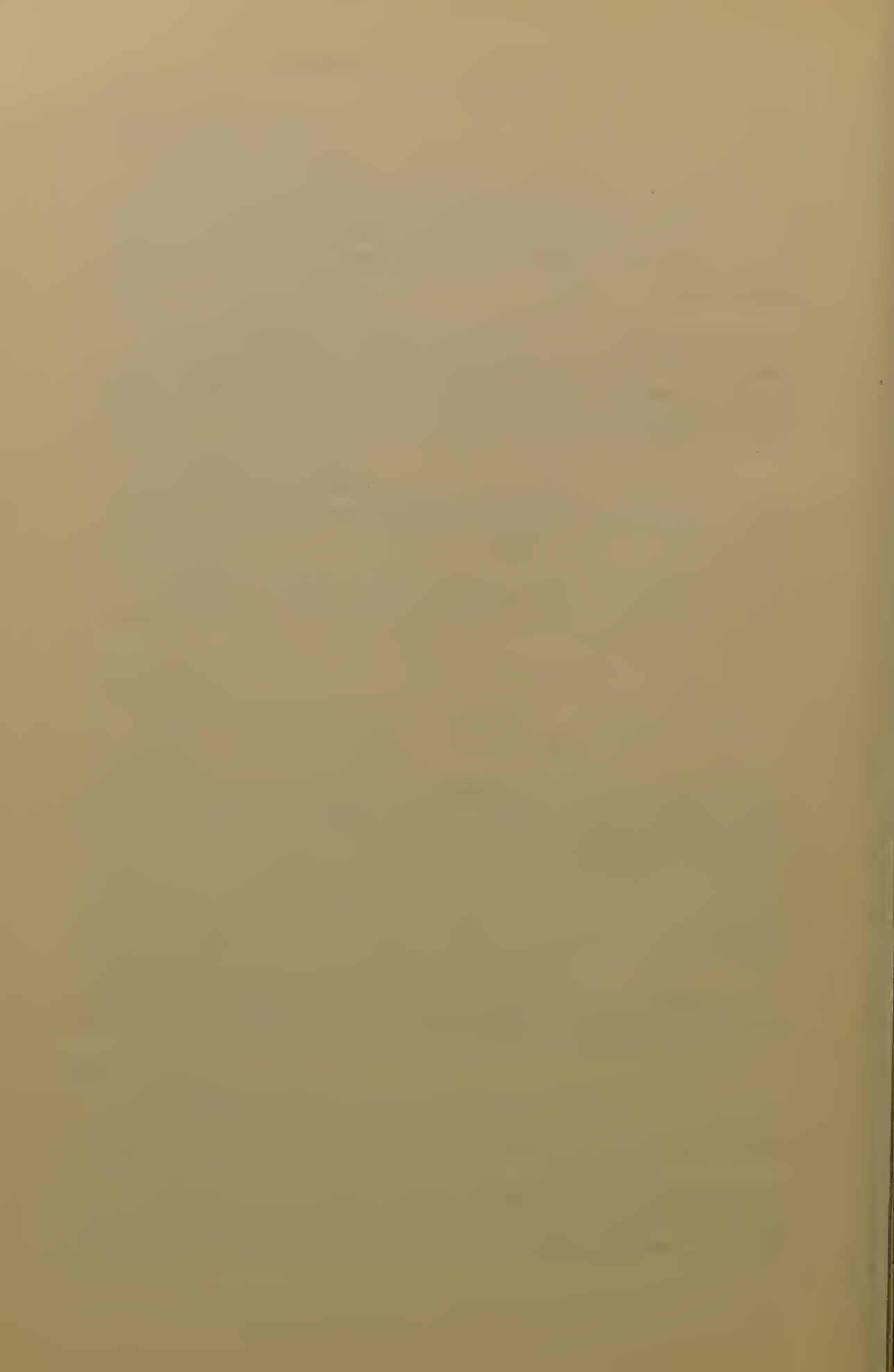
Oil of Sage.

(German: Salbei-Oel.)

Distilled from the leaves of *Salvia officinalis* Linné (Nat. Ord. *Labiatae*).

A yellowish or greenish-yellow liquid, having the penetrating, characteristic odor of sage. Specific gravity 0.915 to 0.925. Optically dextrogyrate. The oil contains small amounts of pinene and cineol, but





its chief constituent is thujone $C_{10}H_{16}O$ (formerly termed *salviol*), which also occurs in the oils of thuja, tansy, and wormwood (see Liebig's *Annalen*, 227, 1885, p. 289, and 252, 1889, p. 94).

The oil is used to a small extent medicinally.

Oil of Satureja.

(German: Satureja-Oel.)

Distilled in southern Spain from the herb of *Satureja Thymbra* (Nat. Ord. *Labiatae*).

The oil has an exceedingly strong and penetrating, thymol-like odor. Specific gravity 0.906. It consists for the most part of cymol, with about 19 per cent. of thymol, and some pinene, dipentene, and bornyl acetate. It has the properties of a powerful stimulant and antiseptic. See also *Oil of Summer Savory*.

Oil of Scurvy Grass, see Oil of Cochlearia, Synthetic.

Oil of Serpentaria.

(German: Schlangenwurz-Oel.)

Distilled from the rhizome and roots of *Aristolochia Serpentaria* Linné and *A. reticulata* Nuttall, "Virginia Snakeroot" (Nat. Ord. *Aristolochiaceae*).

The oil has an amber or light brown color, and an odor resembling that of camphor and valerian. Specific gravity 0.975 to 0.988. Optical rotation -4° . It is stated by J. C. Peacock (*Amer. Journ. Pharm.*, 1891, p. 257) to contain a terpene (probably pinene), an ester of borneol, a body of the composition $C_{18}H_{29}O$, and a green or bluish-green fraction.

Oil of Snakeroot, Canada, see Oil of Asarum Canadense.

Oil of Snakeroot, Virginia, see Oil of Serpentaria.

Oil of Spice Bush.

(German: Spicebush-Oel.)

Distilled from the bark, berries, leaves, and twigs of *Lindera Benzoin* Blume (Nat. Ord. *Lauraceae*). The plant is known also as *Fever-bush*, *Benjamin-bush*, or *Wild Allspice*.

The oil from the *bark* has an odor reminding of wintergreen, a specific gravity of 0.923, and boils between 170° and 300° C.

The oil from the *berries* has an aromatic, spicy, and camphor-like odor, a specific gravity of 0.855, and boils between 160° and 270° C.

The oil from the *leaves* has a very agreeable, lavender-like odor, and a specific gravity of 0.888.

The oil from the *twigs* has an odor reminding of camphor and calamus, and a specific gravity of 0.923.

None of these oils appear as yet to have been chemically examined.

Oil of Spike, see **Oil of Lavender, Spike**, under
(German: Spik-Oel.) **Oil of Lavender Flowers**, Part I.

Oil of Spruce.

(German: Spruce-Oel.)

This oil is distilled from the leaves and twigs of either *Picea alba* Link. (White Spruce) or *Picea nigra* Link. (Black Spruce), Nat. Ord. *Coniferae*.

It is a colorless liquid, having a characteristic and agreeable odor. Commercial oils from authentic sources we have found to have a specific gravity ranging from 0.905 to 0.912, and an optical rotation of $-22^{\circ} 20'$ to $-25^{\circ} 50'$.

This Oil of Spruce is apparently the product which was examined in the laboratory of Messrs. Schimmel & Co., Leipsic, and designated as "Hemlocktannen-Oel," with reference to its supposed botanical source from *Abies canadensis* Michx., which is popularly known in America as "Hemlock Spruce." The latter, however, is believed to be the source of the commercial *Oil of Hemlock*, which is probably similar in composition to the true Oil of Spruce.

The above described Oil of Spruce must therefore be considered to contain lævogryate pinene, cadinene $C_{15}H_{24}$, and bornyl acetate, the latter in amounts of about 3.6 per cent. (see Schimmel & Co.'s *Bericht*, April, 1893, p. 30). Compare also *Oil of Hemlock*.

Oil of Star Anise, see **Oil of Anise, Star**.

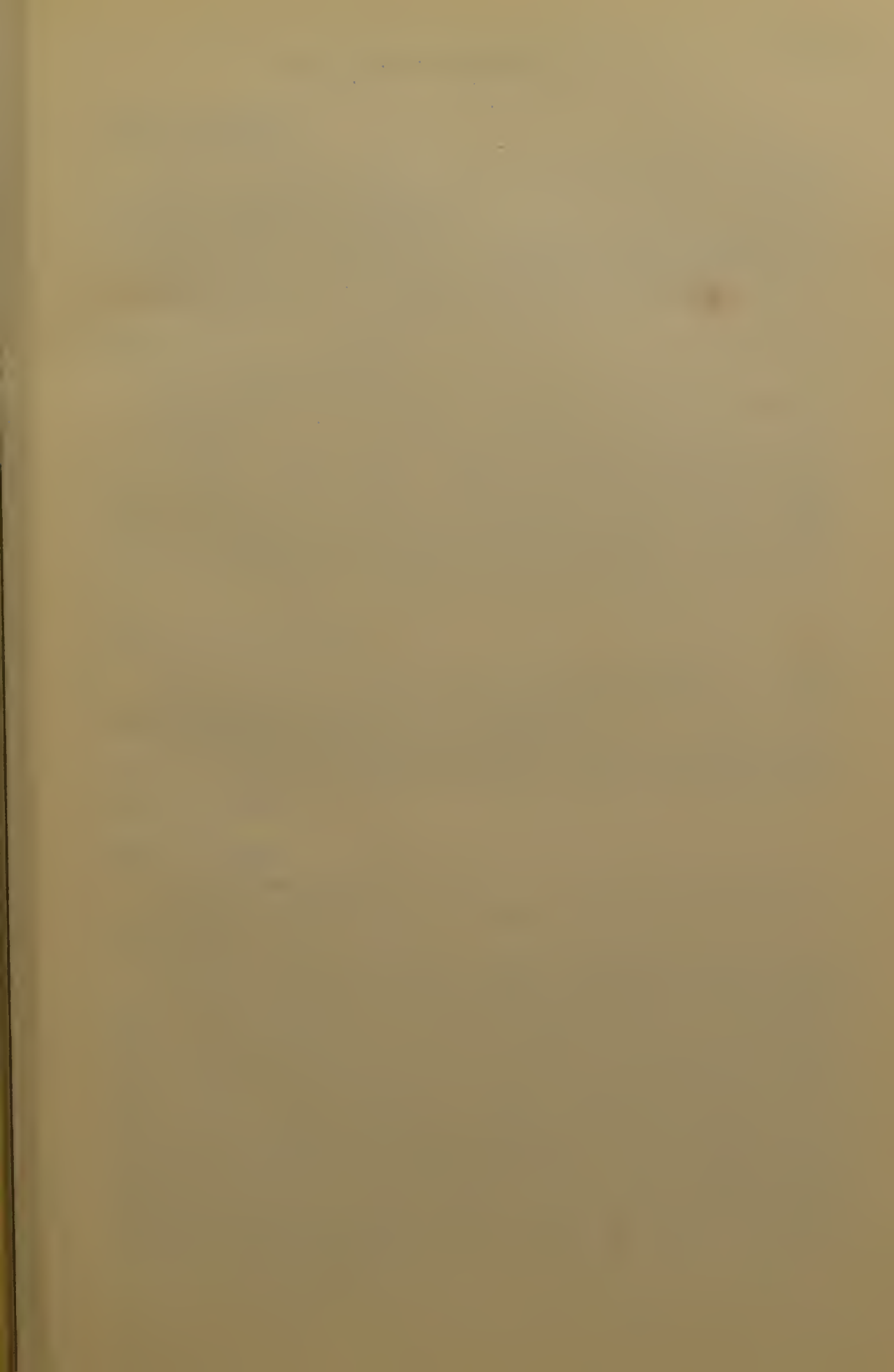
Oil of Storax.

(German: Storax-Oel.)

Distilled from Storax, a balsam prepared from the inner bark of *Liquidambar orientalis* Miller (Nat. Ord. *Hamamelaceae*).

This oil has a specific gravity of 0.890 to 0.900, and an optical rotation of -15° . It contains styrol $C_6H_5-CH=CH_2$, and several esters of cinnamic acid. It boils between 150° and 300° C., with decomposition, and the separation of cinnamic acid.

It is of value in perfumery, and for this purpose is capable of completely displacing storax balsam. Through improved methods of distillation, the oil now prepared by Messrs. Schimmel & Co. is particularly rich in its most valuable odorous constituents, which are the less volatile esters (see *Bericht*, April, 1894, p. 52).



Oil of Sumbul.

(German: Moschuswurzel-Oel.)

Distilled from the root of *Ferula Sumbul* Hooker filius, or so-called Musk Root (Nat. Ord. *Umbelliferae*).

This oil has a strong odor, resembling that of musk, for which it is sometimes used as a substitute. Its specific gravity is 0.954.

Nothing appears to be known of its chemical constituents.

Oil of Summer Savory.

(German: Bohnenkraut-Oel.)

Distilled from the fresh herb of *Satureja hortensis* Linné (Nat. Ord. *Labiatae*).

A yellow, limpid liquid, having an aromatic, thyme-like odor. Specific gravity 0.898 to 0.913. It contains carvacrol $C_{10}H_{14}O$ (about 30 per cent.), traces of another phenol, cymol $C_{10}H_{14}$, and a terpene having a boiling point of 178° to 180° C. (see *Ber. d. deutsch. chem. Ges.*, 15, 1882, p. 816). Compare also *Oil of Satureja*.

Oil of Sweet Fern.

(German: Comptonia-Oel.)

Distilled from the leaves of *Myrica asplenifolia* Endl., or *Comptonia asplenifolia* Aiton (Nat. Ord. *Myricaceae*).

This oil has a strongly spicy, cinnamon-like odor. Specific gravity 0.926. In a freezing mixture it becomes solid. It has not yet been further examined.

Oil of Tansy.

(German: Rainfarn-Oel.)

Distilled from the herb of *Tanacetum vulgare* Linné (Nat. Ord. *Compositae*).

A yellowish liquid, becoming brown on exposure to light and air, and having a strong odor. The specific gravity of the oil from fresh herb is 0.915 to 0.930, and that from dried herb 0.954. It contains a ketone termed tanacetone $C_{10}H_{16}O$, which is identical with thujone from thuja oil, and which also occurs in the oils of sage and wormwood. The oil also appears to contain tanacetyl alcohol $C_{10}H_{18}O$, and a small amount of a terpene (see *Ber. d. deutsch. chem. Ges.*, 11, p. 450, 25, pp. 3343, 3352, 3513; also Schimmel & Co.'s *Bericht*, April, 1893, p. 50). We have observed that the oil forms a perfectly clear solution with three times its volume of 70 per cent. alcohol, which may serve as an excellent practical test for its purity. It has decidedly poisonous properties.

Oil of Thuja.

(German: Thuja-Oel.)

Distilled from the leaves of *Thuja occidentalis* Linné, the so-called Arbor Vitæ or White Cedar (Nat. Ord. *Coniferae*).

A pale yellow liquid, having a characteristic, rather agreeable odor. The commercial oil from authentic sources has been found to have a specific gravity varying from 0.915 to 0.925, and an optical rotation of -8° to -14° C. An oil distilled in our Garfield factory has a specific gravity of 0.922, and an optical rotation of $-6^{\circ} 10'$. The oil contains thujone $C_{10}H_{16}O$, which is also found in the oils of tansy, sage, and wormwood, together with levogyrate fenchone $C_{10}H_{16}O$, pinene, and apparently some inactive carvol (see Liebig's *Annalen*, Bd. 272, p. 99, Bd. 277, p. 159; also Schimmel & Co.'s *Bericht*, April, 1893, p. 57, April, 1894, p. 52).

The oil of thuja forms a perfectly clear solution with 3 times its volume of 70 per cent. alcohol at about 20° C. This test is of practical importance, as serving to distinguish this oil from the Oil of Red Cedar leaves (from *Juniperus Virginiana* Linné), which is not soluble in 70 per cent. alcohol. Compare *Oil of Cedar Leaves, American*.

Oil of Thuja Root.

(German: Thujawurzel-Oel.)

Distilled from the root of *Thuja orientalis* Linné (Nat. Ord. *Coniferae*).

This oil has an intense brown color, and an odor reminding of thymoquinone. Its specific gravity is 0.979. It has not been further examined.

Oil of Thyme, Wild, see under **Oil of Thyme, Part I.**

Oil of Tolu Balsam, see **Oil of Balsam Tolu.**

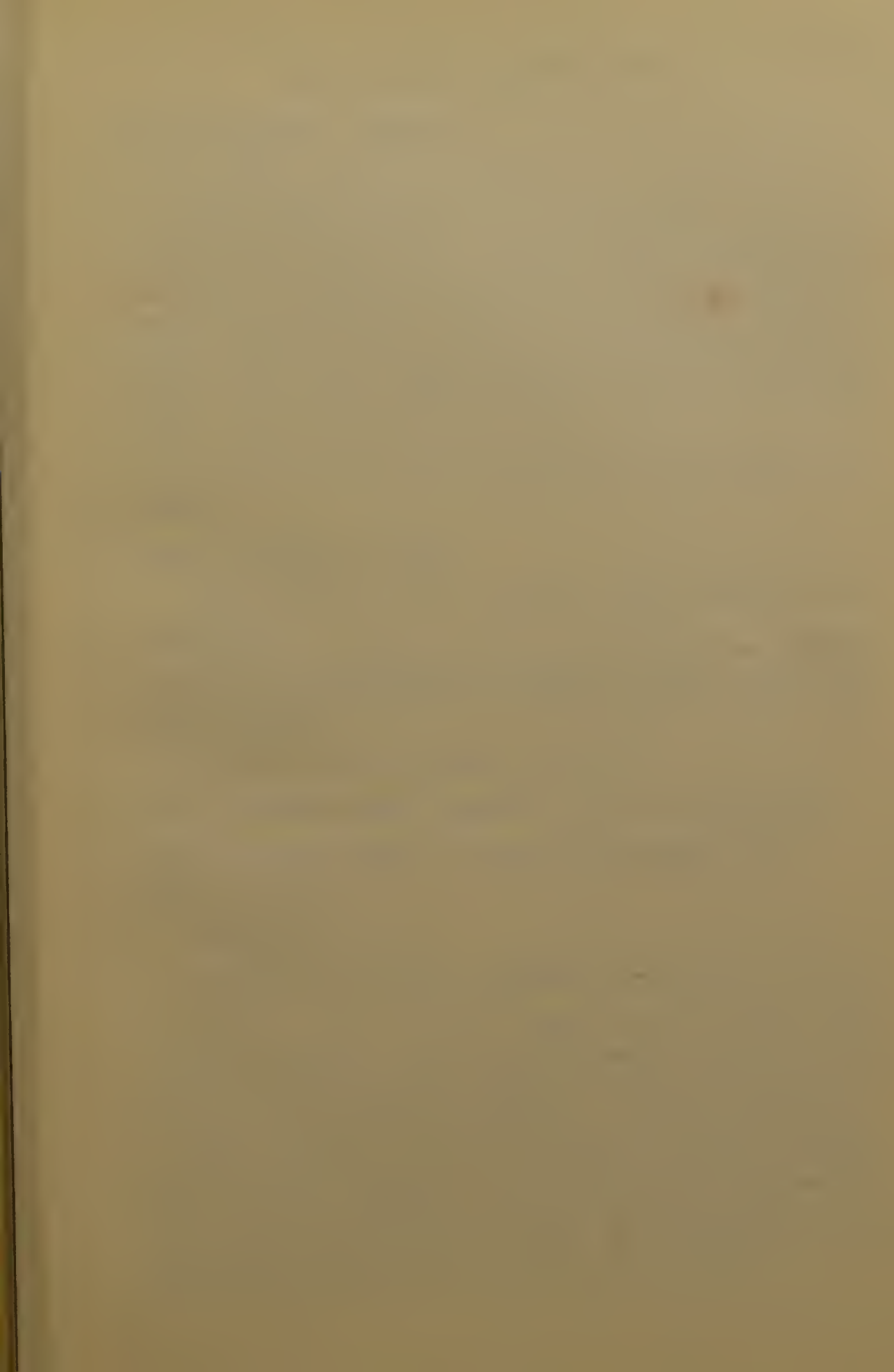
Oil of Valerian.

(German: Baldrian-Oel.)

Distilled from the rhizome and roots of *Valeriana officinalis* Linné (Nat. Ord. *Valerianaceæ*).

This oil was recognized by the U. S. Pharmacopœia of 1880, but is now discarded from the official list. It has a yellowish or brownish color, and a characteristic, penetrating odor. Specific gravity 0.940 to 0.950. It contains pinene, camphene, borneol, and the formic, acetic, and iso-valerianic esters of borneol (see *Ber. d. deutsch. chem. Ges.*, 11, 1878, p. 452, and *Compt. rend.*, 117, p. 1096).

It is used medicinally in various nervous affections.



Oil of Valerian, Japanese.

[Kesso Oil.]

(German: Baldrian-Oel, Japanisches.)

Distilled from the rhizome and roots of *Valeriana officinalis* Linné, var. *angustifolia* Miq. (Nat. Ord. *Valerianaceae*).

This oil has a green color, a somewhat thickish consistence, and can scarcely be distinguished in odor from the ordinary oil of valerian. Specific gravity 0.996. It contains laevogyrate pinene, camphene, dipentene, terpineol, borneol, the acetic and iso-valerianic esters of borneol, kessyl acetate $C_{14}H_{23}O-C_2H_3O_2$, probably also a sesquiterpene $C_{15}H_{21}$, and in the high boiling portions a blue oil (see *Archiv der Pharm.*, 228, p. 483, and *Journ. für prakt. Chemie*, N. F., 49, 1894, p. 18).

The uses of this oil are the same as those of the ordinary oil of valerian.

Oil of Valeriana Celtica.

(German: Speik-Oel.)

Distilled from the root of *Valeriana celtica* Linné (Nat. Ord. *Valerianaceae*).

This oil has a strongly aromatic odor, reminding more of Roman chamomile and patchouly than of valerian oil. Specific gravity 0.967. It boils between 250° and 300° C., but appears not to have been further examined.

It has been used as a perfume in soaps, etc.

Oil of Verbena, East Indian, see Oil of Lemongrass.

Oil of Verbena, Java, see Oil of Citronella Fruit.

Oil of Vetiver.

[Cuscus Oil.]

(German: Vetiver-Oel.)

Distilled from the root of *Andropogon muricatus* Retz (Nat. Ord. *Gramineae*).

The oil is thickish, and has a strong and very agreeable odor, reminding somewhat of violet. Specific gravity 1.01 to 1.02. It is soluble in twice its volume of 80 per cent. alcohol. Nothing appears to be known of its chemical composition. It is used in perfumery.

Messrs. Schimmel & Co. (*Bericht*, April, 1893, p. 59, and April, 1894, p. 53) have found that the oil distilled in the island of Réunion cannot serve as a substitute for the oil distilled from the Indian root, and with modern appliances. The *Réunion vetiver* oil has a much milder odor, a specific gravity of 0.968, and is insoluble in 80 per cent. alcohol, these characters indicating its adulteration.

Oil of Virginia Snake Root, see Oil of Serpentaria.

Oil of Walnut Leaves.

(German: Nussblütter-Oel.)

Distilled from the fresh leaves of *Juglans regia* Linné (Nat. Ord. *Juglandaceæ*).

This oil has an agreeable, tea-like odor, and is solid at ordinary temperatures. It has not yet been further examined.

Oil of Water Fennel.

(German: Wasserfenchel-Oel.)

Distilled from the fruit of *Phellandrium aquaticum* Linné (Nat. Ord. *Umbelliferae*).

The oil is yellow, limpid, and has the peculiar odor of water-fennel. Specific gravity 0.860 to 0.890. It contains pinene, phellandrene, and dipentene (see *Gazetta Chim. Ital.*, XVI, p. 225).

Oil of Water Mint.

(German: Wassermintz-Oel.)

Distilled in southern Spain from the fresh herb of *Mentha aquatica* Linné (Nat. Ord. *Labiatae*).

The oil has a yellowish-green color, and an odor reminding of pennyroyal. Specific gravity 0.880. Optical rotation $-2^{\circ} 14'$.

Oil of White Ash Bark.

(German: Eschenrinden-Oel, Amerikanisches.)

Distilled from the bark of *Fraxinus Americana* Linné (Nat. Ord. *Oleaceæ*).

This oil has a characteristic, fruit-like odor, and a butter-like consistence at ordinary temperatures. It has not yet been further examined.

Oil of White Cedar, see Oil of Thuja.

Oil of Wild Carrot, see Oil of Carrot, Wild.

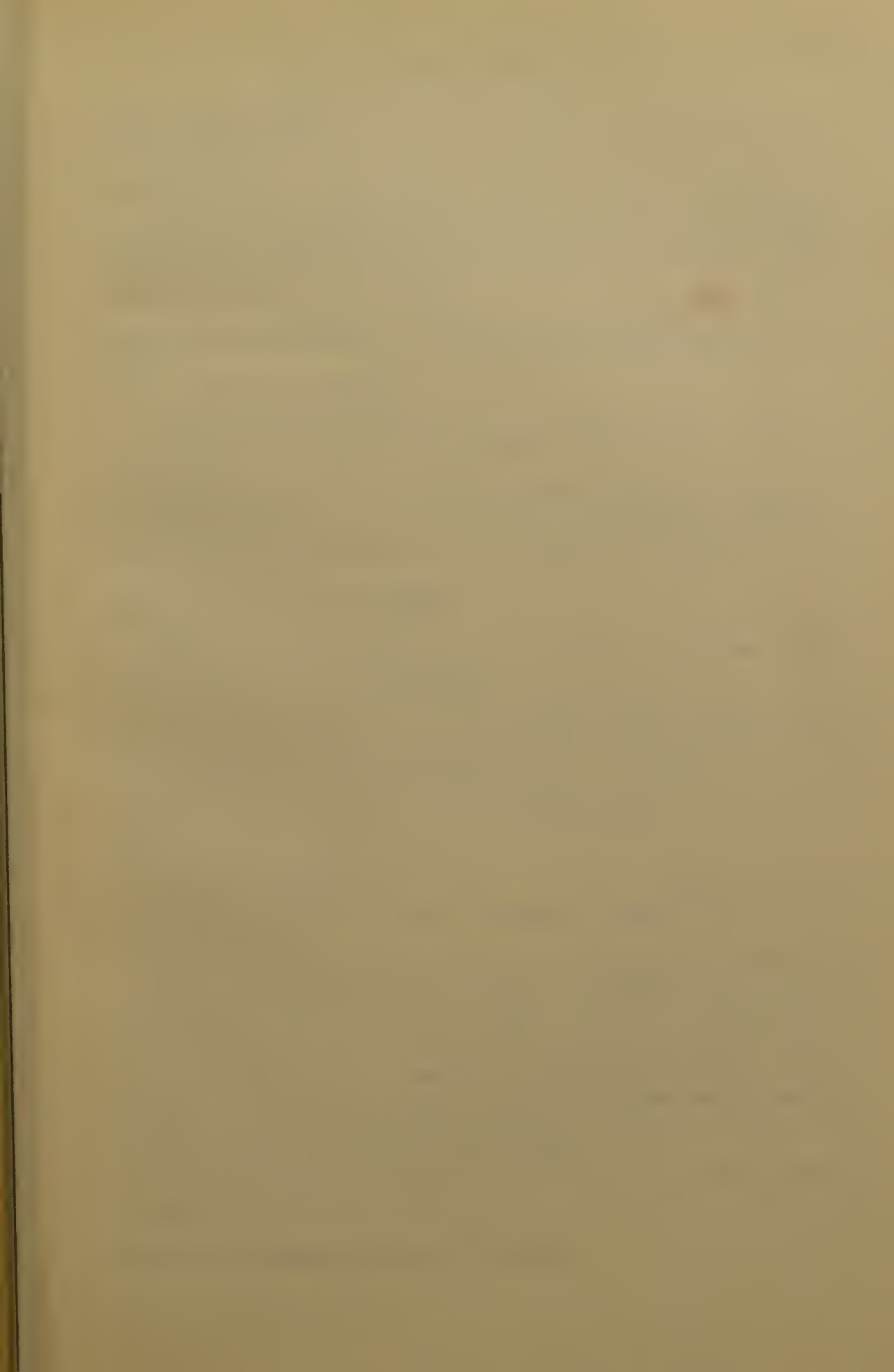
Oil of Wild Cherry Bark.

(German: Wildkirschenrinde-Oel.)

Distilled from the bark of *Prunus serotina* Ehrhart (Nat. Ord. *Rosaceæ*).

This oil resembles that of bitter almonds. Specific gravity 1.050. It consists for the most part of benzaldehyde, and is rich in hydrocyanic acid.

Oil of Wild Ginger, see Oil of Asarum Canadense.



Oil of Wild Mint.

Distilled from the dried herb of *Mentha Canadensis* Linné (Nat. Ord. *Labiatae*).

The oil has a reddish-yellow color, and an odor reminding of pennyroyal. Specific gravity 0.943 at 15° C. It forms a clear solution with twice its volume of 70 per cent. alcohol. Its chemical composition has not yet been determined.

Oil of Wild Thyme, see under **Oil of Thyme**, Part I.

Oil of Winter's Bark.

(German: Wintersrinden-Oel.)

Distilled from the bark of *Drimys Winteri* Forst. (Nat. Ord. *Magnoliaceae*).

Specific gravity 0.945. Its chief constituent appears to be a hydrocarbon boiling between 260° and 265° C., and therefore probably a sesquiterpene, but it has not yet been sufficiently examined.

Oil of Wormseed, Levant.

(German: Zittwersamen-Oel.)

Distilled from the unexpanded flower heads of *Artemisia pauciflora* Weber (Nat. Ord. *Compositae*).

The oil has a yellowish color, and a penetrating, disagreeable odor. Specific gravity 0.930. It consists chiefly of cineol $C_{10}H_{18}O$, with some dipentene (see Liebig's *Annalen*, 225, 1884, p. 291).

It is used to a small extent medicinally. When taken in any considerable amount it possesses marked toxic properties.

Oil of Wormwood.

(German: Wermuth-Oel.)

Distilled from the leaves of *Artemisia Absinthium* Linné (Nat. Ord. *Compositae*).

The oil from the fresh herb has a dark green color, while that from the dry herb is yellowish-green or yellowish-brown, always becoming dark brown, however, by age. It has a strong and somewhat unpleasant odor, resembling that of the plant. Specific gravity 0.925 to 0.950. Its chief constituent is thujone (absynthol) $C_{10}H_{16}O$, which is associated with a small amount of terpenes, and a deep blue oil in the higher boiling portions (see Liebig's *Annalen*, 170, 1873, p. 290, and *Ber. d. deutsch. chem. Ges.*, 25, p. 3350).

The oil is used to a small extent medicinally, but also possesses strongly toxic properties.

Oil of Yarrow, see **Oil of Milfoil**.

Oil of Ylang Ylang.

(German: Ylang-Ylang-Oel.)

Distilled in Manila from the flowers of *Cananga odorata* Hooker fil. et Thomson (Nat. Ord. *Anonaceae*).

This oil is noted for its delicious perfume, especially the brand known as "Sartorius," which represents the finest attainable quality. Specific gravity 0.940 to 0.955. Optical rotation -45° to -60° . It contains an ester of benzoic acid, and, according to the recent researches of Beychler (*Bull. Soc. Chim.*, 1894, 11-12, p. 407), an alcohol of the formula $C_{10}H_{18}O$, and a sesquiterpene. The alcohol, which has been designated as "Ylangol," appears to bear some relation to geraniol. It boils between 103° and 107° C., under a pressure of 28 Mm., has a specific gravity of 0.886 at 15° C., and on oxidation with a chromic acid mixture yields a small amount of a substance having an odor resembling citral. (See also *Oil of Cananga, Java.*)

Oil of Zedoary.

(German: Zittwerwurzel-Oel.)

Distilled from the rhizome of *Curcuma Zedoaria* Roscoe (Nat. Ord. *Zingiberaceae*).

The oil has a pale yellow color, and a camphor-like odor. Specific gravity 0.992. It contains cineol, $C_{10}H_{18}O$.

PART III.

ORGANIC CHEMICAL PREPARATIONS.

Acetic Ether, see **Ethyl Acetate**.

Acid Acetic, Glacial.

(*German*: Eisessig.)

Acidum Aceticum Glaciale.

$\text{C}_2\text{H}_4\text{O}_2$ or $\text{CH}_3\text{-COOH}$.

Nearly or quite absolute Acetic Acid, corresponding to the characters and tests described in the U. S. Pharmacopœia, 1890.

Amyl Acetate. $\text{C}_5\text{H}_{11}\text{-C}_2\text{H}_3\text{O}_2$.

(*German*: Amylacetat.)

This preparation consists chiefly of iso-amyl acetate, which is a colorless, neutral liquid, having an agreeable, pear-like odor, and is therefore sometimes known as "Pear Oil." Specific gravity 0.875 at 15° C. Boiling point about 138° C.

Amyl Butyrate. $\text{C}_5\text{H}_{11}\text{-C}_4\text{H}_7\text{O}_2$.

(*German*: Amylbutyrat.)

This preparation consists chiefly of iso-amyl butyrate, which is a colorless liquid, having an agreeable, apricot-like odor. Specific gravity 0.852 at 15° C. Boiling point about 178° C.

Amyl Formate. $\text{C}_5\text{H}_{11}\text{-CHO}_2$.

(*German*: Amylformiat.)

This preparation consists chiefly of iso-amyl formate, which is a colorless liquid, having a fruity odor. Specific gravity 0.874 at 21° C. Boiling point about 123° C.

Amyl Nitrite. $\text{C}_5\text{H}_{11}\text{NO}_2$.

(*German*: Amylnitrit.)

Amyl Nitris.

The official preparation represents a liquid containing about 80 per cent. of amyl (principally iso-amyl) nitrite, together with variable quantities of undetermined compounds.

It is "a clear, yellow or pale yellow liquid, having a peculiar, ethereal, fruity odor, and a pungent, aromatic taste. Specific gravity 0.870 to 0.880. It is very volatile, even at a low temperature, and is inflammable, burning with a fawn-colored flame. It boils at about 96° to 99° C., yielding an orange-colored vapor."

We have succeeded in producing this preparation in a degree of purity which is rarely met with in a commercial article. Our product has a specific gravity of 0.8789 at 15° C., and, when assayed by the official gasometric method, yields an amount of nitric oxide corresponding to 100 per cent. of pure amyl nitrite.

Amyl Nitrite is a very important and active medicinal agent.

Amyl Valerianate. $C_5H_{11}-C_5H_9O_2$.

(German: Amylvalerianat.)

This preparation consists chiefly of iso-amyl valerianate, which is a colorless liquid, having an agreeable odor, resembling that of apples, and is therefore sometimes known as "Apple Oil." Specific gravity 0.879 at 0° C. Boiling point about 188° C.

Anethol. $C_{10}H_{12}O$ or $C_6H_4 \begin{cases} OCH_3 \\ CH=CH-CH_3 \end{cases}$.

[Para-methoxy-propenyl-benzol.]

(German: Anethol.)

This substance represents the essential constituent of the oil of anise in a state of the greatest purity, and is especially characterized by its pure anise flavor and fine aroma, as also by the following physical properties: It is absolutely colorless, melts at 21° to 22° C., and has a specific gravity of 0.985 at 25° C. It boils at 234° C., and is optically inactive.

The definite characters of anethol render it well adapted to displace with advantage the oil of anise for all purposes for which the latter is used.

Anisic Aldehyde (*Alubépine*). $C_7H_8O_2$ or $C_6H_4(OCH_3)COH$.

(German: Anisaldehyd.)

This substance resembles in odor the blooming Hawthorn (*Crataegus*). It is a definite chemical body, having the following characters: A clear, colorless liquid. Specific gravity 1.126 at 15° C. Boiling point 245° to 246° C. At ordinary temperatures it is liquid, but solidifies in a freezing mixture to a solid, crystalline mass, which melts at -4° C. If it be carefully cooled to -10° C. it still remains liquid, but will at once solidify on bringing in a trace of crystallized anisic aldehyde, when the temperature rises to -4° C. On exposure to the air it oxidizes readily to anisic acid, and should therefore be kept in well-stoppered bottles, which should be as completely filled as possible. It is readily soluble in alcohol, and is used in perfumery and in soaps.

Apiol. $C_{12}H_{14}O_4$.

(German: Apiol.)

This is a constituent of the Oil of Parsley, from the fruit of *Apium Petroselinum* Linné (*Petroselinum sativum* Hoffm.). It forms handsome, needle-shaped crystals, which melt at $30^{\circ}C$., and should therefore be kept in a cool place (see *Ber. d. deutsch. chem. Ges.*, 21, pp. 1621, 2516; 22, p. 2481; 23, p. 323). It has been used to some extent as a substitute for quinine.

Benzoic Ether, see **Ethyl Benzoate**.**Benzyl Acetate.** $C_6H_5-CH_2-C_2H_3O_2$.

(German: Benzylacetat.)

A colorless liquid, having an aromatic, pear-like odor, especially when diluted. Specific gravity 1.057 at $16.5^{\circ}C$. Boiling point $206^{\circ}C$.

Bergamiol, see **Linaloyl Acetate**.**Butyric Ether**, see **Ethyl Butyrate**.**Borneol** (*Borneo Camphor*, *Artificial*). $C_{10}H_{17}-OH$.

(German: Borneol.)

This is a handsomely crystallizable substance, having an odor quite different from that of common camphor, and reminding somewhat of patchouly and ambergris. It melts at 203° to $204^{\circ}C$., and boils at $212^{\circ}C$. It is readily soluble in alcohol, but almost insoluble in water. Borneol possesses antiseptic properties, and is also adapted for use in perfumery.

Iso-borneol. This body, as its name indicates, is an isomer of the above described borneol. Its odor is also more agreeable than the latter, reminding of tansy and sage, and it also shows marked differences in its solubility in benzol and petroleum benzin, and in its chemical deportment. It melts at $212^{\circ}C$. (in a closed tube). By dehydrating agents it is converted into camphene $C_{10}H_{16}$, and by oxidation it forms ordinary camphor $C_{10}H_{16}O$ (see Bertram and Walbaum, in *Journ. für prakt. Chem.*, N. F., 49, 1894, pp. 1-15; also *Compt. rend.*, 118, p. 248; and Schimmel & Co.'s *Bericht*, October, 1893, p. 54, April, 1894, p. 66). It has also been shown by Bertram and Walbaum that the borneol of commerce, which is obtained by the reduction of common camphor with sodium, is not a simple body, but a mixture of borneol and iso-borneol, in which the former predominates.

Borneol or Borneo Camphor occurs as a natural product not only in the wood of the tree known botanically as the *Dryobalanops aromatica* Gärtn. (Nat. Ord. *Dipterocarpacee*), but has also been found,

chiefly in the form of esters, in the following essential oils. Oil of Rosemary, Satureja, Spanish Thyme (*Thymus capitatus*), Valerian, Japanese Valerian (Kesso), *Picea alba* (Spruce), *Abies sibirica*, *Pinus Picea*, *Pinus Pumilio*, *Pinus sylvestris*, and Citronella.

The so-called Blumea Camphor or "Ngai" Camphor of the Chinese, from *Blumea balsamifera* DC. (Nat. Ord. *Compositae*), has the same composition as Borneo Camphor, and appears to be identical with it, with the exception that it is optically lævo-rotatory in about the same degree that Borneo camphor is dextro-rotatory.

Bornyl Acetate. $C_{10}H_{17}-C_2H_3O_2$.

(German: Bornylacetat.)

This body is found in many of the pine-needle oils, and possesses the characteristic aroma of the latter. It crystallizes in rhombic prisms, which melt at 29° C., and are readily soluble in alcohol. Specific gravity 0.991 at 15° C. It boils at 106° to 107° C. under a pressure of 15 Mm.

It is admirably adapted for replacing the pine oils in confections, etc.

Bornyl Formate. $C_{10}H_{17}-CHO_2$.

(German: Bornylformiat.)

This body is liquid, but its odor resembles that of the preceding acetate. Specific gravity 1.017 at 15° C. It boils at 98° to 99° C. under a pressure of about 15 Mm.

Bornyl Valerianate. $C_{10}H_{17}-C_5H_9O_2$.

(German: Bornylvalerianat.)

This body is an essential constituent of the oil of valerian, and probably possesses the action of the latter to an increased extent. Specific gravity 0.956 at 15° C. It boils at 128° to 130° C. under a pressure of about 10 Mm.

Butyl Acetate. $C_4H_9-C_2H_3O_2$.

(German: Butylacetat.)

This preparation consists chiefly of iso-butyl acetate, which is a colorless liquid, having an agreeable, banana-like odor. Specific gravity 0.8845 at 16° C. Boiling point 116° C.

Butyl Butyrate. $C_4H_9-C_4H_7O_2$.

(German: Butylbutyrat.)

This preparation consists chiefly of iso-butyl butyrate. It is a colorless liquid, having an agreeable, fruity odor. Specific gravity about 0.870 at 15° C. Boiling point about 157° C.

Butyl Iso-sulphocyanate, see

Oil of Cochlearia, Synthetic, Part II.

Butyl Valerianate. $C_4H_9-C_5H_9O_2$.

(*German*: Butylvalerianat.)

This preparation consists chiefly of iso-butyl valerianate. It is a colorless liquid, having an agreeable, fruity odor. Specific gravity about 0.860 at 15° C.

Carvacrol. $C_{10}H_{13}-OH$ or $C_3H_7.C \begin{smallmatrix} \diagup CH-C(OH) \\ \diagdown CH=CH \end{smallmatrix} \diagup C.CH_3$.

[Oxy-cymol.]

(*German*: Carvacrol.)

This is the essential constituent of the Oil of Origanum, Cretian, and is also found in the Oils of Thyme and Summer Savory.

It is a thickish, aromatic liquid, which solidifies at $-25^\circ C$., and is isomeric with carvol. Specific gravity 0.981 at 15° C. Boiling point 236° to $237^\circ C$. Its alcoholic solution is colored green by ferric chloride.

Carvene. $C_{10}H_{16}$.

(*German*: Carven.)

This hydrocarbon is found in the Oil of Caraway, and is identical with dextrogyrate limonene. Specific gravity 0.850 at 15° C. Boiling point 175° to $176^\circ C$.

Carvol. $C_{10}H_{14}O$ or $C_3H_7.C \begin{smallmatrix} \diagup CH-CO \\ \diagdown CH=CH \end{smallmatrix} \diagup C.CH_3$.

(*German*: Carvol.)

This body, which is chemically a ketone, is the essential constituent of Oil of Caraway, and is also found in a dextrogyrate form in the Oil of Dill, while its lævogryrate modification occurs in the Oil of Spearmint. It is officially recognized by the German Pharmacopœia, which describes it as follows: "A pale yellowish or colorless liquid, having a fine odor of caraway. Specific gravity 0.960. Boiling point $224^\circ C$. 1 Cc. of carvol, diluted with 1 Cc. of alcohol, should either not be changed or assume only a slight reddish or violet color on the addition of a drop of solution of ferric chloride." The latter solution should for this purpose be quite dilute.

Carvol possesses all the valuable properties of the Oil of Caraway in a perfectly pure and definite form. It also has the advantage over the latter oil of being much more freely soluble in diluted alcohol.

Citral. $C_{10}H_{16}O$.

(*German*: Citral.)

This body, as its name indicates, is chemically an aldehyde, and represents in a state of the greatest purity the delightful aroma of

lemon oil, being contained in the latter to the amount of about 7.5 per cent.

It is a golden-yellow liquid, having a specific gravity of 0.899 at 15° C. It boils at 116° C. under a pressure of 16 Mm., or, when perfectly pure, at 228° to 229° C. under ordinary pressure, without decomposition.

By means of the special aldehyde reaction described under Citronellal, Citral may be converted into the so-called *citryl-β-naphtho-cinchoninic acid*, $C_{10}H_8 \begin{smallmatrix} N:C_9H_{15} \\ C:CH \end{smallmatrix}$, which forms lemon-yellow laminæ, fusing at 197° C. COOH

Citral has the advantage of being much more freely soluble in diluted alcohol than the oil of lemon, but is best used in combination with the latter in order to obtain the desired freshness of aroma. This may be attained by mixing 1 part of Citral with 15 parts of pure Oil of Lemon, and this combination is equivalent in strength and aroma to twice its weight of good lemon oil.

To protect Citral from change it should be kept in a cool and dark place.

Besides being an essential constituent of the oil of lemon, Messrs. Schimmel & Co. have found Citral to occur in the oils of the fruit of *Citrus Limetta* Risso (Linné), *Citrus Madurensis* Loun. (Mandarin), *Tetranthera citrata* Nees (Citronella Fruit), *Xanthoxylum piperitum* DC. (Japanese Pepper), and in the oils of *Andropogon citratus* DC., *Eucalyptus Staigeriana*, and *Bockhausia citriodora* (*Bericht*, April, 1891, p. 52).

Citronellal or Citronella Aldehyde. $C_{10}H_{18}O$.

(German: Citronellaldehyd.)

This body occurs in the Oil of Citronella, Oil of *Eucalyptus maculata*, var. *citriodora*, and in very small amount in the Oil of Lemon. It was formerly regarded as a ketone, and therefore received the designation *citronellone* (see Schimmel & Co.'s *Bericht*, October, 1888, p. 17).

It is a colorless liquid, having a very agreeable, somewhat lemon-like odor, reminding also of citronella oil, but much finer than the latter. Its specific gravity is about 0.880 at 15° C. It distills between 205° and 210° C., with slight decomposition (*Bericht*, October, 1890, p. 21). Compare also Semmler, in *Ber. d. deutsch. chem. Ges.*, 24, p. 209, 26, p. 2254; Kremers, in *Amer. Chem. Journ.*, XIV, p. 203; and Dodge, *Ibidem*, XI, p. 456, and XII, p. 553.

An apparently specific, and therefore very valuable reaction for aldehydes, by means of which they may be detected in essential oils



or separated therefrom in the form of well crystallizable compounds, has recently been proposed by O. Doebner (see *Ber. d. deutsch. chem. Ges.*, 27, 1894, p. 352). It depends upon the formation of α -alkyl- β -naphthocinchoninic acids, by bringing together a molecule of the aldehyde with a molecule each of pyro-racemic acid and β -naphthylamine. The reaction appears to be characteristic of the aldehydes and does not take place with other bodies which likewise contain a carbonyl group, CO, such as ketones, lactones, and the anhydrides of dibasic acids. Thus citronella aldehyde forms the so-called *citronellone- β -naphthocinchoninic acid*, $C_{10}H_6 \begin{smallmatrix} N:C_9H_{17} \\ C:CH \end{smallmatrix} \begin{smallmatrix} COOH \\ \end{smallmatrix}$, which crystallizes in colorless needles, fusing at 225° C.

Cumarin, Synthetic. $C_9H_6O_2$ or $C_6H_4 \begin{smallmatrix} O - CO \\ CH = CH \end{smallmatrix}$
(German: Cumarin.)

This is the aromatic or odorous principle of the Tonka Bean, and is found also in the Sweet Clover (*Melilotus*), and in the numerous other plants enumerated below.

Cumarin is a definite chemical substance, and that produced by us synthetically is perfectly identical in every respect with the same substance obtained from any of its various natural sources, while having the advantage of absolute purity. It forms small, colorless crystals, which fuse at 67° C.

On account of its exceedingly agreeable odor, it has become a very important article in the manufacture of perfumery, for perfuming soaps, etc., and may replace with advantage the Tonka Bean, wherever the latter has heretofore been used. It is soluble to a greater or less extent in most of the ordinary solvents. The following table, representing its solubility in alcohol of different percentage strengths, and in water, at different degrees of temperature, will be found practically useful:

100 Parts of Alcohol	Dissolve at 0° C.	Dissolve at 16 to 17° C.	Dissolve at 29 to 30° C.
Of 90 per cent. by volume	7.1 parts	13.7 parts	42.5 parts
" 80 " " " "	6.0 "	12.3 "	38.3 "
" 70 " " " "	4.4 "	9.1 "	26.0 "
" 60 " " " "	3.2 "	6.0 "	16.0 "
" 50 " " " "	1.7 "	3.4 "	8.9 "
" 40 " " " "	0.7 "	1.5 "	3.9 "
" 30 " " " "	0.3 "	0.6 "	1.7 "
" 20 " " " "	0.2 "	0.4 "	0.8 "
" 10 " " " "	0.15 "	0.25 "	0.5 "
100 Parts of Water	0.12 "	0.18 "	0.27 "

The wide distribution of Cumarin in the vegetable kingdom is indicated by the following enumeration of the plants or parts of plants in which it has thus far been found:

FILICES (Polypodiaceæ).	<i>Adiantum pedatum</i> Linné (Herb).
	“ <i>peruvianum</i> Linné (Herb).
	“ <i>trapeziforme</i> Linné (Herb).
	<i>Drynaria Willdenovi</i> (Herb).
PALMÆ.	<i>Phoenix dactylifera</i> Linné (the common Date).
GRAMINEÆ.	<i>Anthoxanthum odoratum</i> Linné (Herb).
	<i>Atavia Horsfeldii</i> (Herb).
	<i>Cinna arundinacea</i> Linné (Herb).
	<i>Hierochloa alpina</i> R. & S. (Herb).
	“ <i>australis</i> R. & S. (Herb).
	“ <i>borealis</i> R. & S. (Rhizome).
	<i>Milium effusum</i> Linné (Herb).
ORCHIDACEÆ.	<i>Aceras anthropophora</i> R. Br. (Herb).
	<i>Angreeum fragrans</i> Thouars (Leaves).
	<i>Nigritella angustifolia</i> Rich. (Herb).
	<i>Orehis fusea</i> Jacqu. (Herb).
CARYOPHYLLACEÆ.	<i>Herniaria glabra</i> Linné (Herb).
RUTACEÆ.	<i>Ruta graveolens</i> Linné (Herb).
LEGUMINOSÆ.	<i>Copaifera Salikounda</i> Heckel (Ripe Seed).
	<i>Dipterix odorata</i> Willd. (Ripe Seed).
	“ <i>oppositifolia</i> Willd. (Ripe Seed).
	“ <i>Pteropus</i> Mart. (Ripe Seed).
	<i>Melilotus albus</i> Desr. (Flowers and Herb).
	“ <i>altissimus</i> Thuillier (Flowers & Herb).
	“ <i>hamatus</i> Stocks. (Flowers & Herb).
	“ <i>leucanthus</i> W. & A. (Flowers & Herb).
	“ <i>officinalis</i> Desr. (Flowers and Herb).
	<i>Toluifera Balsamum</i> Miller (Fruit).
APOCYNACEÆ.	<i>Alyxia stellata</i> R. & S. (Bark).
RUBIACEÆ.	<i>Asperula odorata</i> Linné (Herb).
	<i>Galium triflorum</i> Michx. (Herb).
COMPOSITÆ.	<i>Liatris odoratissima</i> Willd. (Herb).
	“ <i>spicata</i> Willd. (Herb).
	<i>Ageratum mexicanum</i> Sims (Herb).

Cymol or Cymene. $C_{10}H_{14}$ or $C_6H_4 < \begin{smallmatrix} CH_3 \\ C_3H_7 \end{smallmatrix}$

[Para methyl-isopropyl benzol.]

(German: Cymol.)

This hydrocarbon occurs in the oils of cumin, thyme, ajowan, and some other essential oils. It is a colorless liquid, having an agreeable odor. Specific gravity 0.8678 at 12° C. Boiling point 175° to 176° C.

Ether, Oenanthic (*Cognac Oil, Artificial*).

(German: Oenanthiäther or Künstliches Cognac-Oel.)

This consists of the ethyl esters of the higher monobasic fatty acids. It is a colorless, oily liquid, having a characteristic cognac-like



odor. It has in recent years been considerably employed for imparting a fruity aroma to soaps, and a specially agreeable effect is produced by mixing it with a little Peru balsam, and the oils of cassia and lavender.

Ether, Sebacie. $(C_2H_5)_2C_{10}H_{16}O_4$.

(German: Sebacinsäureäther.)

A colorless or slightly yellowish liquid, having a slightly aromatic odor. Specific gravity 0.968. Boiling point 311° C. at 762 Mm. barometric pressure.

Ethyl Acetate (*Acetic Ether*).

(German: Aethylacetat. Essigäther.)

Aether Aceticus.

$C_2H_5-C_2H_3O_2$.

This preparation is recognized by the U. S. Pharmacopœia, 1890, to which reference may be made for a full description of its characters. The article supplied by us is perfectly pure, and meets all the official requirements, which is not the case with much of the commercial article.

Ethyl Benzoate (*Benzoic Ether*). $C_2H_5-C_7H_5O_2$.

(German: Aethylbenzoat.)

A colorless, aromatic liquid. Specific gravity 1.055 at 15° C. Boiling point 212° to 213° C.

Ethyl Butyrate (*Butyric Ether*). $C_2H_5-C_4H_7O_2$.

(German: Aethylbutyrat.)

A colorless, neutral liquid, possessing in a diluted condition an agreeable, pineapple-like odor and taste; it is therefore sometimes known as "Pineapple Oil." Specific gravity 0.900 at 18° C. Boiling point 120° to 121° C.

It is used for imparting flavor to confections and beverages.

Ethyl Formate (*Formic Ether*). $C_2H_5-CHO_2$.

(German: Aethylformiat.)

A colorless, very limpid, neutral liquid, of agreeable odor. Specific gravity 0.915 at 15° C. Boiling point 54° to 55° C.

Ethyl Nitrite (*Nitrous Ether*). $C_2H_5NO_2$.

(German: Aethylnitrit. Salpetrigsäure Aethyläther.)

Pure ethyl nitrite is a mobile liquid, having a penetrating, but agreeable, apple-like odor. It has a specific gravity of 0.900 at 15° C., and boils at 18° C. It is only used in the form of an alcoholic solution, such as the official Spirit of Nitrous Ether (*Spiritus Aetheris Nitrosi*, U. S. P.), which contains about 4 per cent. of pure ethyl nitrite.

As pure ethyl nitrite has too low a boiling point to permit of its being conveniently or safely kept, we prepare it in the form of a 20 per cent. alcoholic solution, which has a specific gravity of 0.832 at 15° C. To prepare from this the official Spirit of Nitrous Ether, it is simply necessary to mix one (1) volume of the concentrated

solution with four (4) volumes of Deodorized Alcohol. The alcohol used for this purpose should have a specific gravity of about 0.816 at 15° C., corresponding to about 95.1 per cent. by volume of pure ethyl alcohol. In contact with diluted alcohol or water, nitrous ether is quite rapidly decomposed.

Ethyl Oxalate (*Oxalic Ether*). $(C_2H_5)_2C_2O_4$.

(German: Aethyloxalat. Oxaläther.)

A colorless, limpid liquid, having a slightly aromatic, acidulous odor. Specific gravity 1.0824 at 15° C. Boiling point 185° C.

Ethyl Salicylate (*Salicylic Ether*). $C_2H_5-C_7H_5O_3$.

(German: Aethylsalicylat.)

A colorless, or faintly yellowish, aromatic liquid. Specific gravity 1.1345 at 15° C. Boiling point 231° to 232° C.

Ethyl Valerianate (*Valerianic Ether*). $C_2H_5-C_5H_9O_2$.

(German: Aethylvalerianat.)

A colorless, neutral liquid, having an agreeable, fruity odor. Specific gravity 0.866 at 18° C. Boiling point about 135° C.

Eucalyptol (*Cineol*).

(German: Eucalyptol.)

Eucalyptol.

$C_{10}H_{18}O$.

This article has received official recognition in the U. S. Pharmacopœia of 1890, where its characters are fully and accurately described. It is the most valuable constituent of the Eucalyptus Oils, and, being a definite chemical substance, has the advantage over the latter of being of constant composition. The following characters are especially indicative of its purity: "A colorless liquid, having a characteristic, aromatic, and distinctly camphoraceous odor. Specific gravity 0.930 at 15° C. Boiling point 176° to 177° C. It is optically inactive. When exposed to a temperature some degrees below 0° C., or placed in a freezing mixture, it solidifies to a mass of colorless, needle-shaped crystals, which liquefy at -1° C."

The wide distribution of eucalyptol or cineol will be indicated by the following enumeration of the essential oils in which it has thus far been observed to occur.

These are grouped according to the natural orders of the respective plants which afford them:

MYRTACEÆ. *Encalyptus globulus*, *E. oleosa*, *E. odorata*, *E. rostrata*, *E. microcorys*, *E. Bayleyana*, and *E. amygdalina*. *Melaleuca Lencadendron*, *Myrtus Chcken*, and *Myrtus communis*.

COMPOSITÆ. *Artemisia pauciflora* (A. Cina).

LABIATÆ. *Lavandula dentata*, *L. Spica*, *L. stoechas*, *Mentha piperita*, *Rosmarinus officinalis*, *Salvia officinalis*.

- LAURACEÆ. *Laurus Camphora*, *Laurus communis*, *Oreodaphne californica*.
 CANELLACEÆ. *Canella alba*.
 ZINGIBERACEÆ. *Alpinia officinarum*, *Cureuma Zedoaria*, and *Kempferia rotunda*.

Eugenol. $C_{10}H_{12}O_2$ or $C_6H_5\left\{\begin{array}{l}CH_2-CH=CH_2. \\ OCH_3 \\ OH.\end{array}\right.$

[Para-oxy-meta-methoxy-allyl benzol.]

(German: Eugenol.)

This is the essential constituent of the oil of cloves, in which it occurs in amounts of about 75 to 90 per cent. It is also found in the oil of pimenta, oil of bay, oil of massoy bark, and in small amounts in the oils of ceylon cinnamon, sassafras, and in camphor oil. It is a monatomic phenol. When freshly distilled it forms a colorless liquid, having an odor and taste strongly resembling that of the oil of cloves. Specific gravity 1.072 at 15° C. Boiling point 253° to 254° C. (mercurial column entirely in the vapor). It should form a clear solution with a one or two per cent. solution of potassium hydrate.

Eugenol may be used for the same purposes as the oil of cloves, and, being a body of definite and constant composition, its purity may readily be determined by the above mentioned characters.

Formic Ether, see **Ethyl Formate**.

Geraniol. $C_{10}H_{17}-OH$.

(German: Geraniol.)

This is the chief constituent of the true Geranium Oils and of the so-called Turkish Geranium or Palmarosa Oil. It has also quite recently been shown to represent the chief constituent of the liquid portion of the Oil of Rose (see the latter), and it occurs in smaller amounts in the Oil of Citronella, Oil of Lavender Flowers, and the Oil of *Eucalyptus maculata*, var. *citriodora*.

Geraniol is chemically a monatomic alcohol. In a perfectly pure state, as now prepared by us, it forms a colorless liquid, having a fragrant, rose-like odor. Specific gravity 0.882 to 0.885 at 15° C. Boiling point 230° C. Optically inactive. One part of geraniol yields with 12 to 15 times its volume of 50 per cent. alcohol a perfectly clear solution.

Geraniol is very readily oxidized, even by exposure to the air, and its specific gravity and boiling point become thereby increased. It is therefore important that it should be kept in well-stoppered bottles, which should be as completely filled as possible, and stored in a cool place.

By oxidation with a chromic acid mixture it is converted into citral, and with potassium permanganate it yields iso-valerianic acid. Dehydrating agents convert it into terpenes (dipentene and terpinene).

Pure geraniol promises to be of great value to the perfumer and soapmaker. It has a much finer odor than the geranium oils, and

it is not improbable that in some cases it may be capable even of replacing rose oil itself (see Schimmel & Co.'s *Bericht*, April, 1894, pp. 48 and 63).

Geranyl Acetate. $C_{10}H_{17}-C_2H_3O_2$.

(German: Geranylacetat.)

This is a colorless liquid, having an odor resembling that of oil of lavender flowers, but still finer. It boils at 111° to 115° C., under a pressure of about 10 Mm.

It is of great practical value in perfumery.

Geranyl Formate. $C_{10}H_{17}-CH O_2$.

(German: Geranylformiat.)

This compound has a characteristic, agreeable odor. It boils at 104° to 105° C., under a pressure of about 10 Mm.

Helenin (*Alanto-lactone*). $C_{14}H_{20}CO$.

(German: Helenin.)

A crystalline substance obtained from Elecampane, the root of *Inula Helenium* Linné. It fuses at 76° C. It is sparingly soluble in water, but readily soluble in alcohol and in ether. When heated with solutions of the alkalis it is converted into the corresponding salt of alantic acid, $C_{14}H_{20}COOH$. (See also *Oil of Elecampane*, Part II.) It is said to be efficacious in the treatment of cholera, in whooping cough with children, and to possess valuable antiseptic properties.

Heliotropin (*Piperonal*). $C_8H_6O_3$ or $CH_2 < \overset{O}{\underset{O}{\parallel}} > C_6H_3-COH$.

[Methylene ether of protocatechuic aldehyde.]

(German: Heliotropin.)

This especially fine substance possesses in a high degree the exquisite odor of the Heliotrope flower (*Heliotropium peruvianum* Linné), and has therefore become an established and most valuable article in perfumery. It forms small, colorless, shining crystals, which fuse at 37° C., and at higher temperatures volatilize without leaving any residue. It is very sparingly soluble in water, but readily soluble in alcohol, ether, vaseline and glycerin. It is unfavorably influenced by heat and light, and should therefore be kept in a cool, dark place, or, in warm climates, preserved in alcoholic solution.

It is used for imparting the delightful heliotrope odor to perfumes, soaps, and pomades, and is often advantageously combined with cumarin or various essential oils, such as lavender, geranium, sandalwood and petit grains.

Linalool. $C_{10}H_{17}-OH$.

(German: Linalool.)

This is the essential and fragrant constituent of the Oil of Linaloe (see the latter, Part II), and has also been found, either in the free

state or in the form of esters, in the oils of lavender, bergamot, petit grains, and coriander. A similar, if not identical body, "nerolol," has been found in the oil of neroli, and the so-called "asarol," occurring in the oil of *Asarum Canadense* Linné (see the latter, Part II), is likewise apparently identical with linalool.

Linalool is a colorless, or nearly colorless, fragrant liquid, having the characters of a monatomic alcohol. By oxidation with a chromic acid mixture it is converted into citral. Specific gravity 0.878 at 15° C. Boiling point 197° to 198° C. It occurs in two optically different modifications, being either dextrogyrate or lævogyrate. It forms a perfectly clear solution with 2 volumes or more of 70 per cent. alcohol (see *Ber. d. deutsch. chem. Ges.*, 24, 1891, p. 207).

Linalool is a highly esteemed article in perfumery.

Linaloyl Acetate (*Bergamiol*). $C_{10}H_{17}-C_2H_3O_2$.

(German: Linaloylacetat.)

This ester has a strong bergamot odor, and is indeed one of the principal constituents of bergamot oil. It boils at 108° to 110° C., under a pressure of about 10 Mm.

It is a valuable article in perfumery.

Linaloyl Formate. $C_{10}H_{17}-CHO_2$.

(German: Linaloylformiat.)

This ester has an odor reminding of the oils of petit grains and bergamot. It boils at 100° to 103° C., under a pressure of about 10 Mm.

Menthol. $C_{10}H_{19}-OH$.

Menthol.

(German: Menthol.)

This article has received official recognition in the U. S. Pharmacopœia of 1890, and in the German Pharmacopœia, where its general physical characters and tests for purity are described.

It forms "colorless, acicular or prismatic crystals, having a strong and pure odor of peppermint, and a warm, aromatic taste, followed by a sensation of cold, when air is drawn into the mouth. It melts at 43° C. to a colorless liquid, boils at 212° C., and volatilizes slowly at the ordinary temperature. Its alcoholic solution is neutral to litmus paper, and deviates polarized light to the left." The boiling point of pure menthol we find to be at 215.5° C., with the mercurial column of the thermometer entirely in the vapor, and with a barometric pressure of 758 Mm.

Menthol is undoubtedly the most valuable constituent of Peppermint Oil (compare the latter, Part I). Its chemical deportment indicates it to be a secondary alcohol, yielding by moderate oxidation with a chromic acid mixture the ketone known as *menthone*, $C_{10}H_{18}O$, and with organic acids it combines to form esters, such, for example,

as those below described. By the action of dehydrating agents, menthol is converted into the hydrocarbon *menthene* $C_{10}H_{18}$, which boils at $167^{\circ}C$. (For some interesting papers on bodies belonging to the so-called menthol group, see Kremers, in *Proc. Amer. Pharm. Assoc.*, 1892, pp. 273-287; *Ibidem*, 1893, pp. 185-195; and Wallach, in *Liebig's Annalen*, 276, p. 296, and 277, p. 154.)

Menthol is used medicinally for a variety of purposes, both internally, externally, and in the form of inhalation.

Menthyl Formate. $C_{10}H_{19}-CHO_2$.

(German: Menthylformiat.)

This is the formic acid ester of menthol. It congeals at $9^{\circ}C$, and boils at $95^{\circ}C$, under a pressure of about 10 Mm.

Menthyl Valerianate. $C_{10}H_{19}-C_5H_9O_2$.

(German: Menthylvalerianat.)

This is the valerianic acid ester of menthol. It boils at 125° to $127^{\circ}C$, under a pressure of about 10 Mm.

Both of the above compounds may be assumed to possess medicinal value and interest.

Methyl Benzoate (*Niobe Oil*). $CH_3-C_7H_5O_2$.

(German: Methylbenzoat.)

A colorless, aromatic liquid, almost insoluble in water. Specific gravity 1.0950 at $15^{\circ}C$. Boiling point 197.5° to $199.5^{\circ}C$.

Methyl Salicylate, see

Oil of Wintergreen, Synthetic, Part I.

Methyl Valerianate. $CH_3-C_5H_9O_2$.

(German: Methylvalerianat.)

A colorless liquid, having an agreeable, fruity odor. Specific gravity 0.885 at $17^{\circ}C$. Boiling point about $116^{\circ}C$.

Myrtol.

(German: Myrtol.)

This preparation is not a simple, definite substance, but consists of that portion of Oil of Myrtle (see the latter, Part II) boiling between 160° and $180^{\circ}C$, and is therefore a mixture of dextrogyrate pinene, cineol, and dipentene. Its medicinal properties are similar to those of the Oil of Myrtle.

Nerolin I.

(German: Nerolin.)

This substance represents in a remarkable degree the perfume of the Oil of Neroli or Orange Flowers, and is capable of replacing the

latter in perfumes and soaps. It occurs in handsome, white, scale-like crystals, which are readily soluble in alcohol, and in the essential and fatty oils. It melts at 35° C., and should therefore be kept in a cool place.

Nitrous Ether, see **Ethyl Nitrite**.

Oxalic Ether, see **Ethyl Oxalate**.

Safrol. $C_{10}H_{10}O_2$ or $CH_2<\overset{O}{\underset{O}{\parallel}}>C_6H_3-C_3H_5$.

[Methylene ether of allyl-dioxybenzol.]

(German: Safrol.)

This is the essential constituent of the Oil of Sassafras, and it is also contained in Camphor Oil. At ordinary temperatures it is a perfectly colorless liquid, possessing in a high degree the pure aromatic odor of sassafras. Specific gravity 1.108 at 15° C. Boiling point 232° to 233° C. It is optically inactive. At slightly reduced temperatures pure safrol forms large, monoclinic prisms, which melt at 12° C.

Safrol is a definite chemical substance, of constant composition, and is now produced by our Leipsic house on a very large scale, and in the highest degree of purity. It therefore possesses many advantages over the Oil of Sassafras and similar mixtures, which are often merely impure fractional distillates of camphor oil. On account of its pure and highly agreeable odor it has become almost indispensable in the manufacture of soaps, etc. (Compare *Oil of Sassafras*, Part I, and *Oil of Camphor*, Part II.)

Salicylic Ether, see **Ethyl Salicylate**.

Terebene.

Terebenum.

(German: Tereben.)

This preparation has been officially recognized for the first time in the U. S. Pharmacopœia of 1890. A recent investigation, conducted in our Garfield laboratories (see *Pharm. Rundschau*, N. Y., January, 1894), has shown, however, that the commonly accepted definition and description of this compound should be slightly modified. As prepared by us, according to the process originally suggested by Deville, it has the following characters: A colorless liquid, having an agreeable, somewhat aromatic odor, reminding of cymol. Specific gravity about 0.855 at 15° C. Boiling point between 170° and 185° C. *It is perfectly inactive optically.* It consists chiefly of the hydrocarbons dipentene and terpinene, with some cymol and camphene. On account of its tendency to become resinified on exposure to light and air, it should be kept in well-stoppered bottles, in a cool place.

A particularly important test for the purity of this preparation is its optical inactivity, as the presence of unaltered oil of turpentine can thus easily be detected.

Terebene is regarded as a valuable stimulant expectorant, especially in that form of chronic bronchitis known as winter cough. It is also stated to be an active antiseptic and germicide.

Terpin Hydrate. $C_{10}H_{18}(OH)_2 + H_2O$. **Terpini Hydras.**
(German: Terpinhydrat.)

This preparation, like the preceding, has been officially recognized for the first time in the U. S. Pharmacopœia of 1890, where its characters are fully described.

Terpineol. $C_{10}H_{17}-OH$.
(German: Terpineol.)

This is a definite chemical body, having the characters of a monatomic alcohol, and was first brought into commerce by Messrs. Schimmel & Co., of Leipsic. It is a colorless, thick liquid, having a pleasant odor, strongly resembling that of fresh lilac flowers (*Syringa vulgaris* Linné), and has therefore also received the name of "lilacine." Its specific gravity is 0.940 at 15° C. Boiling point 216° to 218° C. It is readily soluble in alcohol, ether, vaseline, and the fatty oils.

Terpineol is a highly esteemed article in the manufacture of fine perfumes or floral extracts, especially the so-called "lilac," and is also used for perfuming toilet soaps.

(For some interesting scientific investigations relating to terpineol and its derivatives, see Wallach, in Liebig's *Annalen*, 275, pp. 103, 151, 277, p. 105; and Baeyer, in *Ber. d. deutsch. chem. Ges.*, 26, p. 826, 27, p. 443.)

Thymol. $C_{10}H_{14}O$ or $C_6H_3 \begin{array}{l} \diagup CH_3 \\ - C_3H_7 \\ \diagdown OH \end{array}$ **Thymol.**
[Methyl-propyl phenol.]
(German: Thymol.)

This body is recognized by both the United States and German Pharmacopœias, where its characters and tests for purity are fully described.

It occurs in the essential oils of *Thymus vulgaris* Linné, *Monarda punctata* Linné (Nat. Ord. *Labiatae*), and *Carum Ajowan* (Roxburgh) Benthams et Hooker (Nat. Ord. *Umbelliferae*).

Thymol forms "large, colorless, translucent crystals of the hexagonal system, having an aromatic, thyme-like odor, and a pungent, aromatic taste, with a very slight caustic effect upon the lips.

Its specific gravity, as a solid, is 1.069 at 15° C., but when liquefied by fusion it is lighter than water. It melts at 50° to 51° C., remaining liquid at considerably lower temperatures. It is soluble in about 1200 parts of water at 15° C., and in less than its own weight of alcohol, ether, or chloroform. Its alcoholic solution is optically inactive."

Thymol possesses valuable antiseptic properties.

Valerianic Ether, see **Ethyl Valerianate.**





